This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

Elementary Arithmetic

Hull

duc T 118.94.460

HARVARD UNIVERSITY

LIBRARY OF THE

Department of Education

COLLECTION OF TEXT-BOOKS
Contributed by the Publishers

TRANSFERRED

GE

3 2044 097 002 455

AN

ELEMENTARY

ARITHMETIC,

WITH ORAL AND WRITTEN EXERCISES.

BY

GEO. W. HULL, M.A., PH.D.,
PROFESSOR OF MATHEMATICS IN THE FIRST PENNSYLVANIA STATE NORMAL SCHOOL, MILLERSVILLE, PA.

BUTLER, SHELDON & COMPANY,
PHILADELPHIA, NEW YORK, CHICAGO.

~~F5,5397~~
EducT 11894.460

[illegible], March 28

Gift of the Publishers.

COPYRIGHT, 1894, BY E. H. BUTLER & CO.

HULL'S ELE. ARITH.

21

HARVARD COLLEGE LIBRARY
TRANSFERRED FROM THE
LIBRARY OF THE
GRADUATE SCHOOL OF EDUCATION

PREFACE.

It is evident to every thoughtful instructor of mathematics that a great many processes are taught in arithmetic to-day which neither furnish the mind with useful knowledge nor develop in it a high degree of culture.

The "Committee of Ten on Secondary School Studies" appointed at the meeting of the National Educational Association, July 9, 1892, recommend, in their report, the omission of a number of processes usually found in elementary arithmetics. In harmony with this report, it has been made an object of this book to eliminate all these unnecessary operations, and to enrich the subject with a large number of exercises in simple calculations and concrete problems. The young pupil will thus be enabled to master the elements of arithmetic with ease and to acquire skill in the use of numbers.

GEO. W. HULL.

MILLERSVILLE, Pa.,
December 28, 1894.

CONTENTS.

SECTION I.

PAGE
ELEMENTARY RESULTS . . . 5

SECTION II.

FUNDAMENTAL PROCESSES . 38
Numeration and Notation . 38
United States Money . . . 42
Addition 44
Subtraction 57
Multiplication 66
Division 76
Short Division 78
Long Division 80
Bills 88
General Review 91

SECTION III.

COMMON FRACTIONS 97
Reduction of Fractions . . 99
Addition of Fractions . . . 104
Subtraction of Fractions . . 106
Fractional Parts of Integers. 108
Fractional Parts of Fractions 110
Multiplication of Fractions. 111
Division of Fractions . . . 115
Arithmetical Analysis . . 120
General Review 123

SECTION IV.

DECIMAL FRACTIONS 127
Numeration and Notation . 128
Reduction of Decimals . . 129
Addition of Decimals . . . 131
PAGE
Subtraction of Decimals . . 131
Multiplication of Decimals. 132
Division of Decimals . . . 133
General Review 136

SECTION V.

DENOMINATE NUMBERS . . 138
United States Money . . . 139
The Money of Other Countries 140
Avoirdupois Weight . . . 140
Liquid Measure 142
Dry Measure 144
Measures of Time 146
Miscellaneous Tables . . . 147
Long Measure 148
Square Measure 150
Applications of Square Measure 151
The Rectangle 151
The Triangle 153
Measures of Volume . . . 154
Applications of Cubic Measure 155
Circular Measure 157
Difference in Time 160
General Review 162

SECTION VI.

PERCENTAGE 166
General Review 171
Interest 173
Miscellaneous Problems . . 177

ELEMENTARY ARITHMETIC.

SECTION I.

ELEMENTARY RESULTS.

THE NUMBER ONE.

● 1.

1. Show me *one* finger; *one* hand; *one* arm.
2. Show me *one* block; *one* book; *one* pencil.
3. Point to *one* chair; *one* table; *one* window.

The *figure* 1 represents *one.*
Make the figure one.

THE NUMBER TWO.

● ● 2.

1. How many hands do you have? How many arms? How many wings has a bird? How many eyes?
2. Show me *two* fingers; *two* hands.

The *figure* 2 represents *two.*
Make the figure two.

3. Show me one block. Put one more block with it.
4. How many blocks do you now have?
5. How many blocks are 1 block and 1 block?

6. How many horses are 1 horse and 1 horse?

7. How many are 1 and 1?

8. Show me two blocks. Take away one block.

9. How many blocks are left?

10. Two blocks less one block are how many blocks?

11. How many horses are 2 horses less 1 horse?

12. How many are 2 less 1?

---

13. Take one block; now take one more. How many *times* have you taken one block?

14. How many, then, are 2 times 1 block?

15. How many are 2 times 1?

---

16. If there are 2 apples, how many boys can each have 1 apple? How many *ones* in 2?

THE NUMBER THREE.

● ● ● 3.

1. Show me 2 blocks. Put one more block with them.

2. How many blocks do you now have?

3. Show me *three* fingers.

The *figure* 3 represents *three.*

4. How many blocks are 2 blocks and 1 block?

5. How many horses are two horses and 1 horse?

6. How many are 2 and 1?

---

7. Show me three blocks. Take one block away. How many are left?

8. Take two blocks away. How many are left?

9. Take three blocks away. How many are left?

10. How many are 3 less 1? 3 less 2? 3 less 3?

11. Take 1 block; take 1 more; and then 1 more. How many *times* have you taken 1 block?

12. How many, then, are 3 times 1 block?

13. How many are 3 times 1 horse?

14. How many are 3 times 1?

---

15. If there are 3 peaches, how many girls can each have 1 peach? How many *ones* in 3?

THE NUMBER FOUR.

● ● ● ● 4.

1. Show me 3 blocks. Put one more block with them. How many blocks do you now have?

2. Show me *four* fingers.

The *figure* 4 represents *four.*

3. How many dots in each of the following groups?

●   ●   ● ●   ●   ●
●   ● ●   ● ●   ● ●   ●

4. Copy these groups, and write under each group the figure representing the number of dots in the group.

1.   2.   3.   4.

5. Copy these figures, and make as many dots under each figure as it represents.

---

6. How many are 3 blocks and 1 block?

7. How many are 3 horses and 1 horse?

8. How many are 3 and 1? 1 and 3?

9. How many are 2 blocks and 2 blocks?

10. How many are 2 and 2?

Show me 4 blocks.

11. Take 1 block away. How many are left?
12. Take 2 blocks away. How many are left?
13. Take 3 blocks away. How many are left?
14. Take 4 blocks away. How many are left?
15. How many are 4 less 1? 4 less 2? 4 less 3? 4 less 4?

---

16. If John takes 1 block at a *time* for four *times*, how many blocks will he have?
17. How many, then, are 4 times 1 block?
18. How many are 4 times 1?
19. If John takes 2 blocks at a time for 2 times, how many blocks will he have?
20. How many are 2 times 2 blocks?
21. How many are 2 times 2?

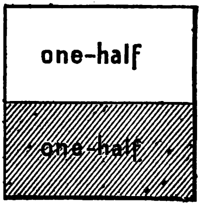
Take 4 blocks. Put them in two equal piles.

22. How many blocks in a pile?
23. How many *twos* in 4?
24. How many *ones* in 4?

---

25. If you divide a square inch into *two equal* parts, what part of the square inch will one part be?

How many halves in a square inch?



A Square Inch.

26. Divide 4 blocks into two equal parts. How many blocks in each part?
27. What is one-half of 4 blocks?
28. What is one-half of 2 apples?

Make a two-inch square.
Divide it into square inches.

29. How many square inches in a two-inch square?

30. What is one-half of 2? One-half of 4?

31. If an orange is worth 4 cents, how much is one-half an orange worth?

32. If one-half an apple is worth 2 cents, how much is a whole apple worth?

33. Draw a straight line and divide it into halves.

THE NUMBER FIVE.

● ● ● ● ● 5.

1. Show me 4 blocks. Put one more block with them. How many blocks do you now have?

Make *five* dots.
The *figure* 5 represents *five.*

2. How many are 4 blocks and 1 block?

3. How many are 3 oranges and 2 oranges?

4. How many are 4 and 1? 3 and 2?

We write the answer thus:

4 and 1 are 5; 3 and 2 are 5; or,
$4 + 1 = 5$; $3 + 2 = 5$.

The sign + takes the place of "*and*," and the sign = takes the place of "*are.*"

5. Read, $4 + 1 = 5$; $2 + 3 = 5$; $3 + 1 = 4$; $2 + 2 = 4$; $2 + 1 = 3$; $1 + 1 = 2$.

6. Write 2 and 3 are 5, using the signs; 4 and 1 are 5; 2 and 2 are 4; 1 and 4 are 5.

Show me 5 blocks.

7. Take 1 block away. How many are left?
8. Take 2 blocks away. How many are left?
9. Take 3 blocks away. How many are left?
10. Take 4 blocks away. How many are left?
11. Take 5 blocks away. How many are left?
12. How many, then, are 5 less 1? 5 less 2? 5 less 3? 5 less 4? 5 less 5?

The sign − takes the place of "*less.*" Thus, 5 less 1 are 4 is written 5 − 1 = 4.

13. Read 5 − 2 = 3; 5 − 3 = 2; 4 − 2 = 2; 4 − 3 = 1; 3 − 1 = 2; 4 − 1 = 3.

14. Write 5 less 1 are 4, using the signs; 5 less 2 are 3; 5 less 4 are 1; 4 less 3 are 1; 3 less 2 are 1.

Copy and complete:

2 + 1 =
3 + 1 =
4 + 1 =
2 + 2 =

3 + 2 =
3 − 1 =
3 −   = 1.
4 −   = 3.

4 −   = 2.
4 −   = 1.
5 −   = 4.
5 −   = 3.

THE NUMBER SIX.

● ● ● ● ● ● 6.

1. How many are 5 blocks and 1 block?

Make six dots.
The *figure* 6 represents *six*.

2. How many are 4 cents and 2 cents?
3. How many are 3 balls and 3 balls?
4. How many, then, are 5 + 1? 4 + 2? 3 + 3?

5. How many are 6 blocks less 1 block?
6. How many are 6 cows less 2 cows?
7. How many are 6 dogs less 3 dogs?
8. How many are 6 boys less 4 boys?
9. How many are 6 boxes less 5 boxes?
10. How many, then, are 6 – 1? 6 – 2? 6 – 3? 6 – 4? 6 – 5? 6 – 6?

---

11. Take 6 blocks. Put them into two equal piles. How many are there in each pile?
12. How many are 2 times 3 blocks?
13. How many are 2 times 3?

Put the 6 blocks into three equal piles.

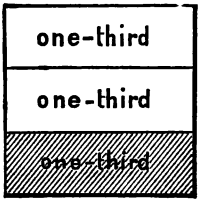
14. How many are there in each pile?
15. How many are 3 times 2 blocks?
16. How many are 3 times 2? 2 times 3?
17. How many are 6 times 1?

William has six cents.

18. To each of how many boys can he give 2 cents?
19. How many *twos* in 6?
20. To each of how many boys can he give 3 cents?
21. How many *threes* in 6?
22. How many *ones* in 6?

---

23. If you divide a square inch into *three* equal parts, what part of a square inch will *one* part be? How many thirds in a square inch?



A Square Inch.

Divide 6 dots into *three* equal parts, thus—

● ● / ● ● / ● ●

24. What is one of these equal parts called?

25. How many dots are there in each part?

26. What is one-third of 6 dots?

27. What is one-third of 6?

28. If you have 6 cents and spend one-third of them, how many do you spend?

29. How many cents have you remaining?

One-third is written thus: $\frac{1}{3}$.
One-half is written thus: $\frac{1}{2}$.

30. What is $\frac{1}{2}$ of 4?

31. What is $\frac{1}{2}$ of 6?

32. What is $\frac{1}{3}$ of 6?

Copy and complete:

$5 + 1 =$
$4 + 2 =$
$3 + 3 =$
$6 - \quad = 5.$

$6 - \quad = 3.$
$6 - \quad = 4.$
$6 - 2 =$
$6 - 1 =$

$4 + \quad = 6.$
3 times 2 =
$\frac{1}{2}$ of 6 =
$\frac{1}{3}$ of 6 =

THE NUMBER SEVEN.

● ● ● ● ● ● ● 7.

1. How many are 6 blocks and 1 block?

Make seven dots.
The *figure* 7 represents *seven.*

---

2. How many are 5 caps and 2 caps?

3. How many are 5 and 2?

4. How many are 4 apples and 3 apples?

5. How many are 4 and 3?

6. How many are 7 melons less 1 melon?

7. How many are 7 boys less 2 boys?

8. How many are 7 cows less 4 cows?

9. How many are 7 cents less 3 cents?

10. How many are 7 cups less 6 cups?

11. How many are 7 oranges less 5 oranges?

12. How many, then, are 7 − 1? 7 − 3? 7 − 5? 7 − 2? 7 − 4? 7 − 6?

13. If a top costs 2 cents and a ball 5 cents, how much will they both cost?

14. Mary paid 1 cent for a pen and 6 cents for a holder; how much did they both cost?

15. Ruth paid 3 cents for an apple and 4 cents for an orange; how much did they both cost?

16. Ross had 7 marbles and lost 2 of them; how many had he left?

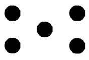
Copy and complete:

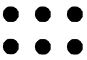
6 + 1 =
5 +   = 7.
4 + 3 =
5 + 2 =

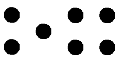
6 +   = 7.
7 − 3 =
7 − 1 =
2 +   = 7.

7 − 4 =
3 + 4 =
4 +   = 7.
7 − 2 =

17. Copy the following groups, and write under each group the figure representing the number of dots in the group:







18. Copy the following figures, and place as many dots under each figure as it represents:

1 2 3 4 5 6 7

THE NUMBER EIGHT.

● ● ● ● ● ● ● ● 8.

1. How many are 7 blocks and 1 block?

Make eight dots.
The *figure* 8 represents *eight.*

---

2. How many are 6 cows and 2 cows?
3. How many are 6 and 2?
4. How many are 5 flags and 3 flags?
5. How many are 5 and 3?
6. How many are 4 boys and 4 boys?
7. How many are 4 and 4?

---

8. How many are 8 blocks less 1 block?
9. How many are 8 cherries less 3 cherries?
10. How many are 8 sleds less 2 sleds?
11. How many are 8 kites less 5 kites?
12. How many are 8 dolls less 4 dolls?
13. How many are 8 caps less 7 caps?
14. How many are 8 pears less 6 pears?
15. How many, then, are 8 less 4? 8 less 5? 8 less 6? 8 less 3? 8 less 7? 8 less 1? 8 less 2?
16. How many are 4 blocks and 4 blocks?
17. How many, then, are 2 times 4 blocks?
18. How many are 2 times 4 apples?
19. How many are 2 times 4?

The sign × takes the place of the word "*times.*" Thus, 2 times 4 are 8 is written $2 \times 4 = 8$.

20. Read $2 \times 2 = 4$; $2 \times 3 = 6$; $2 \times 4 = 8$; $3 \times 2 = 6$; $3 \times 1 = 3$; $4 \times 1 = 4$; $5 \times 1 = 5$.

21. Write 2 times 3 are 6, using the signs; 2 times 4 are 8; 3 times 2 are 6.

---

22. If an orange costs 4 cents, how many oranges can you buy for 8 cents?

23. If a pear costs 2 cents, how many pears can you buy for 8 cents?

24. How many 4's in 8?

25. How many 2's in 8?

---

26. If you divide a square inch into *four* equal parts, what part of a square inch will one part be?

27. How many *fourths* in a square inch? Write one-fourth.

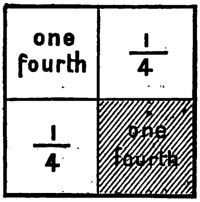
28. Divide a circle into four equal parts. What part of the circle is one of these equal parts?

29. How many fourths in a circle?

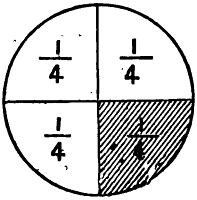
30. If you have 8 cents and spend one-fourth of them, how many do you spend?

31. How many do you have left?

32. If a melon costs 8 cents, how much must you pay for $\frac{1}{4}$ of a melon?



A Square Inch.



A Circle.

Copy and complete:

$7 + 1 =$
$6 + 2 =$
$5 + \quad = 8.$
$4 + \quad = 8.$
$8 - \quad = 7.$

$5 + 3 =$
$2 + \quad = 8.$
$8 - \quad = 3.$
$4 + 4 =$
$8 - \quad = 6.$

$2 \times 4 =$
$\frac{1}{2}$ of $8 =$
$\frac{1}{4}$ of $8 =$
2 is $\frac{1}{2}$ of
4 is $\frac{1}{2}$ of

THE NUMBER NINE.

● ● ● ● ● ● ● ● ● 9.

1. How many are 8 blocks and 1 block?

Make nine dots.
The *figure* 9 represents *nine.*

---

2. How many are 7 men and 2 men?
3. How many are 7 and 2?
4. How many are 6 apples and 3 apples?
5. How many are 6 and 3?
6. How many are 5 tops and 4 tops?
7. How many are 5 and 4?

---

8. How many are 9 blocks less 1 block?
9. How many are 9 pears less 4 pears?
10. How many are 9 apples less 2 apples?
11. How many are 9 coats less 7 coats?
12. How many are 9 cards less 6 cards?
13. How many are 9 cans less 5 cans?
14. How many are 9 cows less 8 cows?
15. How many, then, are 9 less 1? 9 less 2? 9 less 4? 9 less 7? 9 less 8? 9 less 3? 9 less 5? 9 less 6? 9 less 9?

---

16. If John takes 3 blocks at a time for three times, how many blocks will he have?

17. How many, then, are 3 times 3 blocks?

18. How many are 3 times 3 cents?

19. How many are 3 times 3?

20. At 3 cents each, how many oranges can you buy for 9 cents?

21. How many 3's in 9?

22. What is $\frac{1}{3}$ of 9?

23. If you have 9 marbles and give $\frac{1}{3}$ of them away, how many will you have left?

24. What is 9 divided by 3? That is, how many 3's in 9?

9 divided by 3 equals 3 is written $9 \div 3 = 3$. The sign ÷ takes the place of the words "*divided by.*"

25. Read $8 \div 2 = 4$; $6 \div 2 = 3$; $4 \div 2 = 2$; $6 \div 3 = 2$; $9 \div 3 = 3$.

26. Write 9 divided by 3 equals 3, using the signs; 8 divided by 4 equals 2; 6 divided by 3 equals 2; 6 divided by 2 equals 3; 4 divided by 2 equals 2.

27. If an orange costs 4 cents and a melon 5 cents, how much will they both cost?

28. Mary had 6 peaches after she had given her brother 3; how many had she at first?

29. James had 9 cents and spent 4 of them for candy; how many had he left?

30. If a lead pencil costs 3 cents, what will Robert pay for 3 lead pencils?

31. Charles bought oranges at 3 cents apiece; how many could he get for 9 cents?

Copy and complete:

$8 + 1 =$

$2 + \quad = 9.$

$3 + 6 =$

$9 - 1 =$

$7 + 2 =$

$4 + \quad = 9.$

$5 + 4 =$

$9 - 3 =$

$9 - 5 =$

$6 + \quad = 9.$

$7 + \quad = 9.$

$3 \times 3 =$

$9 + 3 =$

$\frac{1}{3}$ of $9 =$

$9 \div \quad = 3.$

The *figure* 0 is called **zero or cipher**, and means *nothing*, or that there are *none to count.*

REVIEW.

Copy the following figures, and make as many dots under each figure as it represents:

1 2 3 4 5 6 7 8 9 0

Copy and complete:

$1 + 2 =$
$2 + 2 =$
$3 + 2 =$
$4 + 2 =$
$5 + 2 =$
$6 + 2 =$
$7 + 2 =$

$2 + 3 =$
$3 + 3 =$
$4 + 3 =$
$5 + 3 =$
$6 + 3 =$
$4 + 4 =$
$5 + 4 =$

$3 - 2 =$
$4 - 2 =$
$5 - 2 =$
$6 - 2 =$
$7 - 2 =$
$8 - 2 =$
$9 - 2 =$

$4 - 3 =$
$5 - 3 =$
$6 - 3 =$
$7 - 3 =$
$8 - 3 =$
$9 - 3 =$
$5 - 4 =$

$6 - 4 =$
$7 - 4 =$
$8 - 4 =$
$9 - 4 =$
$6 - 5 =$
$7 - 5 =$
$8 - 5 =$
$9 - 2 =$

$9 - 5 =$
$7 - 6 =$
$8 - 6 =$
$9 - 6 =$
$8 - 7 =$
$9 - 7 =$
$9 - 8 =$
$8 - 1 =$

$2 \times 1 =$
$2 \times 2 =$
$2 \times 3 =$
$2 \times 4 =$
$3 \times 1 =$
$3 \times 2 =$
$3 \times 3 =$
$5 \times 1 =$

$4 \times 1 =$
$4 \times 2 =$
$\frac{1}{2}$ of $4 =$
$\frac{1}{2}$ of $6 =$
$\frac{1}{2}$ of $8 =$
$\frac{1}{3}$ of $6 =$
$\frac{1}{3}$ of $9 =$
$\frac{1}{2}$ of $2 =$

$6 + \quad = 8.$
$7 - \quad = 5.$
$2 \times \quad = 8.$
$9 \div \quad = 3.$
$8 \div \quad = 2.$
$6 + \quad = 9.$
$9 - \quad = 3.$
$9 - \quad = 4.$

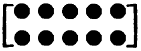
$9 - \quad = 5.$
$8 \div \quad = 4.$
$6 + \quad = 9.$
$2 + \quad = 9.$
$2 \times \quad = 4.$
$6 \div \quad = 3.$
$8 - \quad = 3.$
$8 - \quad = 4.$

$7 + \quad = 9.$
$7 - \quad = 4.$
$3 + \quad = 8.$
$1 \times \quad = 5.$
$2 \times \quad = 6.$
$3 \times \quad = 9.$
$9 \div \quad = 3.$
$6 \div \quad = 3.$

$4 \times \quad = 8.$
$3 - \quad = 2.$
1 is $\frac{1}{2}$ of
2 is $\frac{1}{2}$ of
4 is $\frac{1}{2}$ of
3 is $\frac{1}{3}$ of
3 is $\frac{1}{2}$ of
2 is $\frac{1}{4}$ of

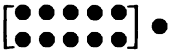
READING AND WRITING NUMBERS FROM 10 TO 20.

1. How many are 9 hats and 1 hat?
Ten is written thus: 10.



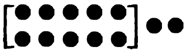
10.

2. How many are 10 dots and 1 dot?
Eleven is written thus: 11.



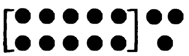
11.

3. How many are 11 dots and 1 dot?
Twelve is written thus: 12.



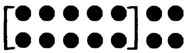
12.

4. How many are 12 dots and 1 dot?
Thirteen is written thus: 13.



13.

5. How many are 13 dots and 1 dot?
Fourteen is written thus: 14.



14.

When two figures are written side by side, the one on the right denotes **ones** *or* **units**, *and the one on the left denotes* **tens.**

6. Write one ten and five units, or fifteen.
7. Write one ten and six units, or sixteen.
8. Write one ten and seven units, or seventeen.
9. Write one ten and eight units, or eighteen.
10. Write one ten and nine units, or nineteen.
11. Read

10	14	16	17	11	16	19	17
12	19	18	15	12	13	14	15

THE NUMBER TEN.

● ● ● ● ● ● ● ● ● ● **10.**

1. Horace had 9 cents and found 1 cent; how many cents did he then have? 9 + 1 = ?

2. May had 8 pinks and Ruth gave her 2 more; how many did she then have? $8 + 2 = \ ?$

3. A farmer had 7 horses and bought 3 more; how many did he then have? $7 + 3 = \ ?$

4. There are 6 girls and 4 boys in a class; how many pupils in the class? $6 + 4 = \ ?$

5. Ross has 5 cents in one hand and 5 cents in the other; how many cents has he in both hands? $5 + 5 = \ ?$

6. Arthur had 10 cents and lost 1 cent; how many cents had he remaining? $10 - 1 = \ ?$

7. How many must you take from 10 to leave 8? To leave 7? To leave 6? To leave 5? To leave 4? To leave 3?

8. If one orange costs 5 cents, what will 2 oranges cost? $2 \times 5 = \ ?$

9. If an apple costs 2 cents, what will 5 apples cost? $5 \times 2 = \ ?$

10. If a pencil costs 5 cents, how many pencils can you buy for 10 cents? $10 \div 5 = \ ?$

11. At 2 cents each, how many pieces of candy can you buy for 10 cents? $10 \div 2 = \ ?$

12. There are 10 cents in a dime; how many cents in $\frac{1}{2}$ of a dime? $\frac{1}{2}$ of $10 = \ ?$

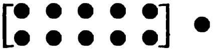
Copy and complete:

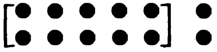
$9 + 1 =$
$10 - 1 =$
$2 \times 5 =$
$10 - \quad = 4.$
$8 + 2 =$

$2 + \quad = 10.$
$5 \times 2 =$
$10 - 5 =$
$7 + 3 =$
$3 + \quad = 10.$

$10 \div 2 =$
$\frac{1}{2}$ of $10 =$
$5 + 5 =$
$10 - 4 =$
$10 \div 5 =$

THE NUMBERS ELEVEN AND TWELVE.


11.


12.

1. How many are 9 balls and 2 balls? 9 + 2 = ?
2. How many are 8 books and 3 books? 8 + 3 = ?
3. How many are 7 bells and 4 bells? 7 + 4 = ?
4. How many are 6 doors and 5 doors? 6 + 5 = ?
5. How many are 9 pens and 3 pens? 9 + 3 = ?
6. How many are 8 boxes and 4 boxes? 8 + 4 = ?
7. How many are 7 days and 5 days? 7 + 5 = ?
8. How many are 6 boys and 6 boys? 6 + 6 = ?

---

9. A boy had 11 marbles and gave 2 away; how many had he remaining? 11 − 2 = ?

10. How many are 11 less 2? 11 less 4? 11 less 3? 11 less 5? 11 less 6?

11. How many are 12 less 4? 12 less 3? 12 less 5? 12 less 6?

---

12. At 6 dollars each, what must I pay for 2 sheep? 2 × 6 = ?

13. What will 3 hats cost at the rate of 4 dollars each? 3 × 4 = ?

14. What will 6 books cost at the rate of 2 dollars each? 6 × 2 = ?

15. There are 12 months in a year. How many months in ½ of a year? In ⅓ of a year? In ¼ of a year?

16. 12 things make a dozen. How many things in ½ of a dozen? In ⅓ of a dozen? In ¼ of a dozen?

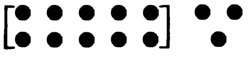
17. 12 is how many times 2? 3? 4? 6?

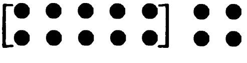
18. How many are 12 less 7? 12 less 8? 12 less 9?

Copy and complete:

9 + 2 = 8 + 3 = 7 + 4 = 6 + 5 =
11 − 2 = 3 + = 11. 4 + = 11. 11 − 5 =
3 + = 12. 4 + = 12. 12 − 5 = 12 − 6 =
2 × 6 = 3 × 4 = 12 ÷ 6 = 12 ÷ 3 =

THE NUMBERS THIRTEEN AND FOURTEEN.


13.


14.

1. How many are 9 cents and 4 cents? 9 + 4 = ?
2. How many are 8 yards and 5 yards? 8 + 5 = ?
3. How many are 7 roses and 6 roses? 7 + 6 = ?
4. How many are 9 eggs and 5 eggs? 9 + 5 = ?
5. How many are 8 yards and 6 yards? 8 + 6 = ?
6. How many are 7 lambs and 7 lambs? 7 + 7 = ?

---

7. Harry had 13 quarts of berries and sold 4 of them; how many remained? 13 − 4 = ?

8. In a class of 13 pupils 6 are boys; how many girls in the class? 13 − 6 = ? 13 less 5 = ? 13 − 5 = ?

9. James is 14 years old, and his brother is 5 years younger; how old is his brother? 14 − 5 = ?

10. A farmer had 14 cows and sold 6 of them; how many had he remaining? 14 − 6 = ?

11. Harold had 14 marbles and gave Oram 7 of them; how many had he left? 14 − 7 = ?

---

12. 7 days make a week; how many days in 2 weeks? 2 × 7 = ?

13. How many cents in 7 two-cent pieces? 7 × 2 = ?

14. If a ball costs 2 cents, how many balls can you buy with 14 cents? $14 \div 2 =$?

15. At 7 cents a pound, how many pounds of sugar can you buy with 14 cents? $14 \div 7 =$?

16. What is $\frac{1}{2}$ of 14?

Copy and complete:

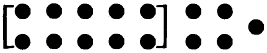
$9 + 4 =$ $\quad 8 + 5 =$ $\quad 7 + 6 =$ $\quad 9 + 5 =$

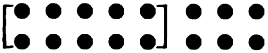
$8 + 6 =$ $\quad 7 + 7 =$ $\quad 14 - 5 =$ $\quad 6 + \quad = 13.$

$7 + \quad = 14.$ $\quad 13 - 5 =$ $\quad 6 + \quad = 14.$ $\quad 4 + \quad = 13.$

$2 \times 7 =$ $\quad \frac{1}{2}$ of $14 =$ $\quad 14 \div 2 =$ $\quad 14 \div 7 =$

THE NUMBERS FIFTEEN AND SIXTEEN.


15.


16.

1. How many are 9 oranges and 6 oranges? $9 + 6 =$?

2. How many are 8 marbles and 7 marbles? $8 + 7 =$?

3. How many are 9 birds and 7 birds? $9 + 7 =$?

4. How many are 8 lamps and 8 lamps? $8 + 8 =$?

---

5. Louis had 15 marbles and gave 6 of them to Gilbert; how many had he left? $15 - 6 =$?

6. A tailor had 15 coats and sold 7 of them; how many had he left? $15 - 7 =$?

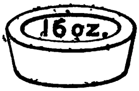
7. A farmer had 16 sheep and sold 7 of them; how many had he left? $16 - 7 =$?

8. How many are 16 less 8? $16 - 8 =$?

9. At 3 dollars each, what will 5 hats cost? $5 \times 3 =$? $3 \times 5 =$?

10. At 2 cents apiece, what must be paid for 8 oranges? $8 \times 2 =$? 2×8 ?

11. Make a 4-inch square and divide it into square inches. How many square inches in it? $4 \times 4 = \ ?$


Pound.

Half-pound.

Quarter-pound.

2 ounces.

12. There are 16 ounces in a pound; how many ounces in $\frac{1}{2}$ of a pound? In $\frac{1}{4}$ of a pound? $\frac{1}{2}$ of $16 = \ ?$ $\frac{1}{4}$ of $16 = \ ?$

13. If a quart of milk costs 5 cents, how many quarts can you buy for 15 cents? $15 \div 5 = \ ?$

14. What is $\frac{1}{3}$ of 15? $\frac{1}{5}$ of $15 = \ ?$

Copy and complete:

$9 + 6 =$
$16 - 7 =$
$5 \times 3 =$
$16 \div \quad = 4.$
$4 \times 4 =$
$8 + 7 =$

$8 + \quad = 16.$
$\frac{1}{3}$ of $15 =$
$16 \div 2 =$
$9 + 7 =$
$15 - 7 =$
$\frac{1}{2}$ of $16 =$

$16 \div \quad = 2.$
$8 + \quad = 16.$
$9 + \quad = 15.$
$\frac{1}{4}$ of $16 =$
$15 \div \quad = 5.$
$5 \times \quad = 15.$

THE NUMBERS SEVENTEEN AND EIGHTEEN.

[● ● ● ● ●] ● ● ●
[● ● ● ● ●] ● ● ● ● 17.

[● ● ● ● ●] ● ● ● ●
[● ● ● ● ●] ● ● ● ● 18.

1. How many are 8 men and 9 men? $8 + 9 = \ ?$

2. How many are 9 boys and 9 boys? $9 + 9 = \ ?$

---

3. Ruth had 17 cents and spent 8 of them; how many had she left? $17 - 8 = \ ?$

4. Lawrence had 18 pigeons and 9 of them flew away; how many had he left? 18 − 9 = ?

---

5. A teacher has 2 classes with 9 pupils in each class; how many in both? 2 × 9 = ? 9 × 2 = ?

6. At 6 dollars a pair, what will 3 pairs of shoes cost?

7. Charles had 18 cents and spent ⅓ of them; how much had he left?

8. What is ½ of 18 apples? ½ of 18 = ?

9. 18 is how many times 3? 6? 9?

Copy and complete:

9 + 8 = 9 + 9 = 18 − 9 = 17 − 8 =
2 × 9 = 3 × 6 = 18 ÷ = 9. 18 ÷ = 2.
18 ÷ 6 = 18 ÷ 3 = ½ of 18 = ⅓ of 18 =

REVIEW.

1. 8 = 3 + ? 8 = 6 + ? 8 = 4 + ? 8 = 7 + ?
2. 9 = 2 + ? 9 = 3 + ? 9 = 5 + ? 9 = 4 + ?
3. 10 = 5 + ? 10 = 6 + ? 10 = 7 + ? 10 = 8 + ?
4. 11 = 8 + ? 11 = 9 + ? 11 = 6 + ? 11 = 5 + ?
5. 12 = 9 + ? 12 = 8 + ? 12 = 7 + ? 12 = 6 + ?
6. 6 = 12 − ? 6 = 13 − ? 6 = 8 − ? 6 = 14 − ?
7. 7 = 9 − ? 7 = 11 − ? 7 = 12 − ? 7 = 13 − ?
8. 8 = 10 − ? 8 = 12 − ? 8 = 16 − ? 8 = 17 − ?
9. 9 = 12 − ? 9 = 16 − ? 9 = 13 − ? 9 = 14 − ?
10. 5 = 14 − ? 5 = 10 − ? 5 = 12 − ? 5 = 13 − ?
11. 12 = 4 × ? 12 = 2 × ? 12 = 3 × ? 12 = 6 × ?
12. 18 = 3 × ? 18 = 2 × ? 18 = 6 × ? 18 = 9 × ?
13. 16 = 2 × ? 16 = 4 × ? 16 = 8 × ? 16 = 2 × ?
14. ½ of 18 = ? ⅓ of 6 = ? ⅓ of 9 = ? ⅓ of 12 = ?
15. ⅓ of 15 = ? ⅓ of 18 = ? ¼ of 8 = ? ¼ of 12 = ?

ADDITION TABLE.

1 + 1 = 2	1 + 2 = 3	1 + 3 = 4	1 + 4 = 5	1 + 5 = 6
2 + 1 = 3	2 + 2 = 4	2 + 3 = 5	2 + 4 = 6	2 + 5 = 7
3 + 1 = 4	3 + 2 = 5	3 + 3 = 6	3 + 4 = 7	3 + 5 = 8
4 + 1 = 5	4 + 2 = 6	4 + 3 = 7	4 + 4 = 8	4 + 5 = 9
5 + 1 = 6	5 + 2 = 7	5 + 3 = 8	5 + 4 = 9	5 + 5 = 10
6 + 1 = 7	6 + 2 = 8	6 + 3 = 9	6 + 4 = 10	6 + 5 = 11
7 + 1 = 8	7 + 2 = 9	7 + 3 = 10	7 + 4 = 11	7 + 5 = 12
8 + 1 = 9	8 + 2 = 10	8 + 3 = 11	8 + 4 = 12	8 + 5 = 13
9 + 1 = 10	9 + 2 = 11	9 + 3 = 12	9 + 4 = 13	9 + 5 = 14
1 + 6 = 7	1 + 7 = 8	1 + 8 = 9	1 + 9 = 10	1 + 10 = 11
2 + 6 = 8	2 + 7 = 9	2 + 8 = 10	2 + 9 = 11	2 + 10 = 12
3 + 6 = 9	3 + 7 = 10	3 + 8 = 11	3 + 9 = 12	3 + 10 = 13
4 + 6 = 10	4 + 7 = 11	4 + 8 = 12	4 + 9 = 13	4 + 10 = 14
5 + 6 = 11	5 + 7 = 12	5 + 8 = 13	5 + 9 = 14	5 + 10 = 15
6 + 6 = 12	6 + 7 = 13	6 + 8 = 14	6 + 9 = 15	6 + 10 = 16
7 + 6 = 13	7 + 7 = 14	7 + 8 = 15	7 + 9 = 16	7 + 10 = 17
8 + 6 = 14	8 + 7 = 15	8 + 8 = 16	8 + 9 = 17	8 + 10 = 18
9 + 6 = 15	9 + 7 = 16	9 + 8 = 17	9 + 9 = 18	9 + 10 = 19

SIGHT ADDITION.

4	4	7	8	5	4	7	8	5	2	4	8
5	6	3	2	7	4	2	3	3	9	6	5
9	10										

2	4	8	4	7	6	7	8	9	4	6	7
5	3	4	6	6	6	7	8	9	5	9	8

3	6	5	6	9	6	9	7	6	8	7	9
9	3	3	6	4	5	3	3	9	8	9	5

9	7	4	8	6	7	7	8	9	6	8	9
4	6	5	8	8	5	7	5	7	9	7	9

SUBTRACTION TABLE.

1 − 1 = 0	2 − 2 = 0	3 − 3 = 0	4 − 4 = 0	5 − 5 = 0
2 − 1 = 1	3 − 2 = 1	4 − 3 = 1	5 − 4 = 1	6 − 5 = 1
3 − 1 = 2	4 − 2 = 2	5 − 3 = 2	6 − 4 = 2	7 − 5 = 2
4 − 1 = 3	5 − 2 = 3	6 − 3 = 3	7 − 4 = 3	8 − 5 = 3
5 − 1 = 4	6 − 2 = 4	7 − 3 = 4	8 − 4 = 4	9 − 5 = 4
6 − 1 = 5	7 − 2 = 5	8 − 3 = 5	9 − 4 = 5	10 − 5 = 5
7 − 1 = 6	8 − 2 = 6	9 − 3 = 6	10 − 4 = 6	11 − 5 = 6
8 − 1 = 7	9 − 2 = 7	10 − 3 = 7	11 − 4 = 7	12 − 5 = 7
9 − 1 = 8	10 − 2 = 8	11 − 3 = 8	12 − 4 = 8	13 − 5 = 8
10 − 1 = 9	11 − 2 = 9	12 − 3 = 9	13 − 4 = 9	14 − 5 = 9
6 − 6 = 0	7 − 7 = 0	8 − 8 = 0	9 − 9 = 0	10 − 10 = 0
7 − 6 = 1	8 − 7 = 1	9 − 8 = 1	10 − 9 = 1	11 − 10 = 1
8 − 6 = 2	9 − 7 = 2	10 − 8 = 2	11 − 9 = 2	12 − 10 = 2
9 − 6 = 3	10 − 7 = 3	11 − 8 = 3	12 − 9 = 3	13 − 10 = 3
10 − 6 = 4	11 − 7 = 4	12 − 8 = 4	13 − 9 = 4	14 − 10 = 4
11 − 6 = 5	12 − 7 = 5	13 − 8 = 5	14 − 9 = 5	15 − 10 = 5
12 − 6 = 6	13 − 7 = 6	14 − 8 = 6	15 − 9 = 6	16 − 10 = 6
13 − 6 = 7	14 − 7 = 7	15 − 8 = 7	16 − 9 = 7	17 − 10 = 7
14 − 6 = 8	15 − 7 = 8	16 − 8 = 8	17 − 9 = 8	18 − 10 = 8
15 − 6 = 9	16 − 7 = 9	17 − 8 = 9	18 − 9 = 9	19 − 10 = 9

SIGHT SUBTRACTION.

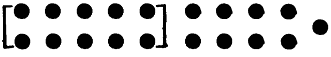
From	12	11	10	10	15	11	11	9	11	12
Take	7	4	5	3	9	2	4	7	8	3
	5	7								

From	13	11	12	13	14	16	13	14	16	14
Take	5	5	4	8	5	9	6	9	8	7

From	15	16	16	17	12	13	14	15	16	18
Take	7	8	9	8	7	5	6	8	7	9

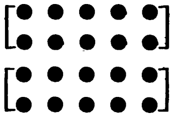
READING AND WRITING NUMBERS FROM 20 TO 100.

1. Nineteen is equal to *one ten* and nine units or ones, and is written thus: 19.



19.

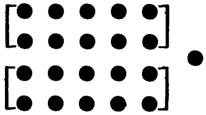
2. If you make 10 dots in one group and 10 dots in another group, how many dots will you have? How many tens?



20.

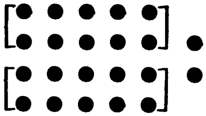
3. Two tens, or *twenty,* is written thus: 20. What does the 2 denote? What does the 0 denote?

4. Express two tens and one, or *twenty-one.*



21.

5. Express two tens and two, or *twenty-two.*



22.

6. Express two tens and three, or *twenty-three.*

7. In 23 what does the 3 denote? What does the 2 denote?

8. How many tens and units in—

24? 27? 30? 53? 55? 63? 70? 85?
25? 28? 38? 47? 59? 61? 75? 97?
26? 29? 42? 82? 45? 73? 77? 34?

9. Read:

63 50 92 86 50 99 30 80
78 19 86 31 66 17 40 96
46 27 47 40 67 20 77 90

10. Express with figures:

Twenty-five.
Twenty-six.
Twenty-seven.
Twenty-eight.
Twenty-nine.
Thirty.
Forty.
Fifty.
Sixty.
Seventy.
Eighty.
Ninety.
Forty-five.
Fifty-seven.
Sixty-nine.
Thirty-one.
Sixty-four.
Seventy-three.
Eighty-six.
Ninety-nine.

---

11. Count by 2's to 18. Thus, 2, 4, 6, 8, etc.
12. Count by 2's from 1 to 19. Thus, 1, 3, 5, 7, etc.
13. Count by 3's from 0 to 18. From 1 to 19.
14. Count by 4's from 0 to 20. From 1 to 17.
15. Count by 4's from 2 to 18. From 3 to 19.
16. Count by 5's from 0 to 20. From 1 to 16.

MULTIPLICATION AND DIVISION TABLES.

The pupil may make the multiplication and division tables, as the **Tables of 2 and 3** are made.

TABLE OF 2.

$1 + 1$ or $2 \times 1 = 2$	$2 \div 2 = 1$
$2 + 2$ or $2 \times 2 = 4$	$4 \div 2 = 2$
$3 + 3$ or $2 \times 3 = 6$	$6 \div 2 = 3$
$4 + 4$ or $2 \times 4 = 8$	$8 \div 2 = 4$
$5 + 5$ or $2 \times 5 = 10$	$10 \div 2 = 5$
$6 + 6$ or $2 \times 6 = 12$	$12 \div 2 = 6$
$7 + 7$ or $2 \times 7 = 14$	$14 \div 2 = 7$
$8 + 8$ or $2 \times 8 = 16$	$16 \div 2 = 8$
$9 + 9$ or $2 \times 9 = 18$	$18 \div 2 = 9$

1. What will 2 pencils cost at 3 cents each? At 4 cents? At 9 cents? At 7 cents? At 8 cents? At 6 cents? At 5 cents?

2. At 2 cents apiece, how many apples can you buy for 12 cents? For 10 cents? For 8 cents? For 18 cents? For 16 cents? For 14 cents? For 6 cents?

Multiply	1	2	7	4	9	6	3	8	5
By	2	2	2	2	2	2	2	2	2
	2	4	14						

TABLE OF 3.

$1 + 1 + 1$	or	$3 \times 1 = 3$	$3 \div 3 = 1$
$2 + 2 + 2$	or	$3 \times 2 = 6$	$6 \div 3 = 2$
$3 + 3 + 3$	or	$3 \times 3 = 9$	$9 \div 3 = 3$
$4 + 4 + 4$	or	$3 \times 4 = 12$	$12 \div 3 = 4$
$5 + 5 + 5$	or	$3 \times 5 = 15$	$15 \div 3 = 5$
$6 + 6 + 6$	or	$3 \times 6 = 18$	$18 \div 3 = 6$
$7 + 7 + 7$	or	$3 \times 7 = 21$	$21 \div 3 = 7$
$8 + 8 + 8$	or	$3 \times 8 = 24$	$24 \div 3 = 8$
$9 + 9 + 9$	or	$3 \times 9 = 27$	$27 \div 3 = 9$

1. What will 3 pounds of sugar cost at 4 cents a pound? At 6 cents? At 9 cents? At 8 cents? At 5 cents? At 7 cents? At 3 cents?

2. At 3 dollars apiece, how many hats can you buy for 9 dollars? For 12 dollars? For 21 dollars? For 27 dollars? For 18 dollars? For 24 dollars? For 15 dollars?

Multiply	1	9	2	8	3	7	4	6	5
By	3	3	3	3	3	3	3	3	3
	3	27							

TABLE OF 4.		TABLE OF 5.	
$4 \times 1 = 4$	$4 \div 4 = 1$	$5 \times 1 = 5$	$5 \div 5 = 1$
$4 \times 2 = 8$	$8 \div 4 = 2$	$5 \times 2 = 10$	$10 \div 5 = 2$
$4 \times 3 = 12$	$12 \div 4 = 3$	$5 \times 3 = 15$	$15 \div 5 = 3$
$4 \times 4 = 16$	$16 \div 4 = 4$	$5 \times 4 = 20$	$20 \div 5 = 4$
$4 \times 5 = 20$	$20 \div 4 = 5$	$5 \times 5 = 25$	$25 \div 5 = 5$
$4 \times 6 = 24$	$24 \div 4 = 6$	$5 \times 6 = 30$	$30 \div 5 = 6$
$4 \times 7 = 28$	$28 \div 4 = 7$	$5 \times 7 = 35$	$35 \div 5 = 7$
$4 \times 8 = 32$	$32 \div 4 = 8$	$5 \times 8 = 40$	$40 \div 5 = 8$
4×9 [illegible] 36	$36 \div 4 = 9$	$5 \times 9 = 45$	$45 \div 5 = 9$

1. What will 4 coats cost at 5 dollars apiece? At 8 dollars? At 7 dollars? At 9 dollars? At 6 dollars?

2. How many trees are there in 5 rows if there are 6 trees in each row? If 5 trees? If 8 trees? If 9 trees? If 7 trees? If 4 trees? If 3 trees?

3. There are 4 quarts in one gallon; how many gallons in 16 quarts? In 20 quarts? In 12 quarts? In 24 quarts? In 36 quarts? In 32 quarts? In 28 quarts?

4. How many five-cent pieces can you get in exchange for 15 cents? For 45 cents? For 10 cents? For 30 cents? For 25 cents? For 35 cents? For 40 cents?

Multiply	2	9	3	8	4	7	5	6	7
By	4	5	4	5	4	5	4	5	4

Multiply	2	9	3	8	4	7	5	6	7
By	5	4	5	4	5	4	5	4	5

Divide—

$5\overline{)15}$ $4\overline{)12}$ $5\overline{)20}$ $4\overline{)16}$ $4\overline{)20}$ $5\overline{)30}$ $4\overline{)24}$

$4\overline{)36}$ $5\overline{)40}$ $4\overline{)32}$ $5\overline{)35}$ $4\overline{)28}$ $5\overline{)25}$ $5\overline{)45}$

TABLE OF 6.		TABLE OF 7.	
6 × 1 = 6	6 ÷ 6 = 1	7 × 1 = 7	7 ÷ 7 = 1
6 × 2 = 12	12 ÷ 6 = 2	7 × 2 = 14	14 ÷ 7 = 2
6 × 3 = 18	18 ÷ 6 = 3	7 × 3 = 21	21 ÷ 7 = 3
6 × 4 = 24	24 ÷ 6 = 4	7 × 4 = 28	28 ÷ 7 = 4
6 × 5 = 30	30 ÷ 6 = 5	7 × 5 = 35	35 ÷ 7 = 5
6 × 6 = 36	36 ÷ 6 = 6	7 × 6 = 42	42 ÷ 7 = 6
6 × 7 = 42	42 ÷ 6 = 7	7 × 7 = 49	49 ÷ 7 = 7
6 × 8 = 48	48 ÷ 6 = 8	7 × 8 = 56	56 ÷ 7 = 8
6 × 9 = 54	54 ÷ 6 = 9	7 × 9 = 63	63 [illegible] 7 = 9

1. What will 6 books cost at 5 cents each? At 9 cents? At 4 cents? At 8 cents? At 6 cents? At 7 cents?

2. What will 7 melons cost at 6 cents each? At 5 cents? At 7 cents? At 4 cents? At 8 cents? At 9 cents?

3. At 6 cents a quart, how many quarts of berries can you buy for 18 cents? For 42 cents? For 48 cents? For 36 cents? For 54 cents? For 30 cents?

4. There are 7 days in a week; how many weeks in 14 days? In 63 days? In 21 days? In 56 days? In 28 days? In 49 days? In 35 days? In 42 days?

Multiply	2	8	3	7	4	6	5	9
By	6	7	6	7	6	7	6	6
	12	56						

Multiply	2	8	3	7	4	6	5	9
By	7	6	7	6	7	6	7	6

Divide—

6)12	7)21	6)30	7)14	6)24	7)28	6)48	7)35
2	3						
7)56	6)18	7)49	6)36	7)63	6)54	7)42	6)42

TABLE OF 8.		TABLE OF 9.	
$8 \times 1 = 8$	$8 \div 8 = 1$	$9 \times 1 = 9$	$9 \div 9 = 1$
$8 \times 2 = 16$	$16 \div 8 = 2$	$9 \times 2 = 18$	$18 \div 9 = 2$
$8 \times 3 = 24$	$24 \div 8 = 3$	$9 \times 3 = 27$	$27 \div 9 = 3$
$8 \times 4 = 32$	$32 \div 8 = 4$	$9 \times 4 = 36$	$36 \div 9 = 4$
$8 \times 5 = 40$	$40 \div 8 = 5$	$9 \times 5 = 45$	$45 \div 9 = 5$
$8 \times 6 = 48$	$48 \div 8 = 6$	$9 \times 6 = 54$	$54 \div 9 = 6$
$8 \times 7 = 56$	$56 \div 8 = 7$	$9 \times 7 = 63$	$63 \div 9 = 7$
$8 \times 8 = 64$	$64 \div 8 = 8$	$9 \times 8 = 72$	$72 \div 9 = 8$
$8 \times 9 = 72$	$72 \div 8 = 9$	$9 \times 9 = 81$	$81 \div 9 = 9$

1. What will 8 coats cost at 5 dollars apiece? At 9 dollars? At 6 dollars? At 7 dollars? At 8 dollars? At 4 dollars? At 3 dollars?

2. What will 9 sheep cost at 7 dollars a head? At 9 dollars? At 6 dollars? At 8 dollars? At 5 dollars? At 7 dollars? At 4 dollars? At 3 dollars?

3. Henry has 9 five-dollar gold-pieces; how many dollars has he in all?

4. A suit of clothes was paid for with 8 five-dollar bills; how many dollars did it cost?

5. There are 8 quarts in a peck; how many pecks in 16 quarts? In 24 quarts? In 32 quarts? In 72 quarts? In 64 quarts? In 56 quarts? In 48 quarts? In 40 quarts?

6. A horse travels 9 miles an hour; how long will it take him to travel 45 miles? 18 miles? 54 miles? 27 miles? 63 miles? 36 miles? 72 miles? 81 miles?

Multiply	2	9	3	8	4	7	5	6
By	8	9	8	9	8	9	8	9
	16							

Divide—

9)18 8)16 9)45 8)24 9)36 8)56 9)63 8)32

9)27 8)40 9)81 8)64 9)45 8)48 9)72 8)72

Multiply	2	9	3	8	4	7	5	6
By	9	8	9	8	9	8	9	8

REVIEW.

Copy and complete:

1. 12 = 3 × 12 = 2 × 12 ÷ 4 = 12 ÷ 6 =
2. 16 = 4 × 16 = 8 × 16 ÷ 8 = 16 ÷ 4 =
3. 18 = 6 × 18 = 9 × 18 ÷ 6 = 18 ÷ 2 =
4. 24 = 3 × 24 = 6 × 24 ÷ 8 = 24 ÷ 3 =
5. 30 = 5 × 30 = 6 × 30 ÷ 6 = 30 ÷ 5 =
6. 36 = 6 × 36 = 4 × 36 ÷ 6 = 36 ÷ 9 =
7. 42 = 6 × 42 = 7 × 42 ÷ 6 = 42 ÷ 7 =
8. 48 = 8 × 48 = 6 × 48 ÷ 6 = 48 ÷ 8 =
9. 54 = 9 × 54 = 6 × 54 ÷ 6 = 54 ÷ 9 =
10. 56 = 7 × 56 = 8 × 56 ÷ 7 = 56 ÷ 8 =
11. 63 = 7 × 63 = 9 × 63 ÷ 7 = 63 ÷ 9 =
12. 72 = 8 × 72 = 9 × 72 ÷ 8 = 72 ÷ 9 =

13. Count by 5's from 5 to 100. Thus, 5, 10, 15, etc.
14. Count by 6's from 6 to 54. From 5 to 53.
15. Count by 7's from 7 to 63. From 6 to 62.
16. Count by 8's from 8 to 72. From 7 to 71.
17. Count by 9's from 9 to 81. From 8 to 80.
18. Count by 6's from 4 to 52. From 1 to 49.
19. Count by 7's from 1 to 50. From 2 to 51.
20. Count by 8's from 1 to 49. From 2 to 50.
21. Count by 9's from 1 to 55. From 2 to 56.

MULTIPLICATION TABLE.

$2 \times 1 = 2$	$3 \times 1 = 3$	$4 \times 1 = 4$	$5 \times 1 = 5$
$2 \times 2 = 4$	$3 \times 2 = 6$	$4 \times 2 = 8$	$5 \times 2 = 10$
$2 \times 3 = 6$	$3 \times 3 = 9$	$4 \times 3 = 12$	$5 \times 3 = 15$
$2 \times 4 = 8$	$3 \times 4 = 12$	$4 \times 4 = 16$	$5 \times 4 = 20$
$2 \times 5 = 10$	$3 \times 5 = 15$	$4 \times 5 = 20$	$5 \times 5 = 25$
$2 \times 6 = 12$	$3 \times 6 = 18$	$4 \times 6 = 24$	$5 \times 6 = 30$
$2 \times 7 = 14$	$3 \times 7 = 21$	$4 \times 7 = 28$	$5 \times 7 = 35$
$2 \times 8 = 16$	$3 \times 8 = 24$	$4 \times 8 = 32$	$5 \times 8 = 40$
$2 \times 9 = 18$	$3 \times 9 = 27$	$4 \times 9 = 36$	$5 \times 9 = 45$
$6 \times 1 = 6$	$7 \times 1 = 7$	$8 \times 1 = 8$	$9 \times 1 = 9$
$6 \times 2 = 12$	$7 \times 2 = 14$	$8 \times 2 = 16$	$9 \times 2 = 18$
$6 \times 3 = 18$	$7 \times 3 = 21$	$8 \times 3 = 24$	$9 \times 3 = 27$
$6 \times 4 = 24$	$7 \times 4 = 28$	$8 \times 4 = 32$	$9 \times 4 = 36$
$6 \times 5 = 30$	$7 \times 5 = 35$	$8 \times 5 = 40$	$9 \times 5 = 45$
$6 \times 6 = 36$	$7 \times 6 = 42$	$8 \times 6 = 48$	$9 \times 6 = 54$
$6 \times 7 = 42$	$7 \times 7 = 49$	$8 \times 7 = 56$	$9 \times 7 = 63$
$6 \times 8 = 48$	$7 \times 8 = 56$	$8 \times 8 = 64$	$9 \times 8 = 72$
$6 \times 9 = 54$	$7 \times 9 = 63$	$8 \times 9 = 72$	$9 \times 9 = 81$

ROMAN NUMERALS.

The Romans wrote numbers with seven capital letters, as follows:

$$\mathrm{I} = 1;\quad \mathrm{V} = 5;\quad \mathrm{X} = 10;\quad \mathrm{L} = 50;\quad \mathrm{C} = 100;$$
$$\mathrm{D} = 500;\quad \mathrm{M} = 1000.$$

Other numbers are expressed by writing side by side two or more of these letters.

If a letter is written *after* another letter of the same or greater value, the *sum* of their values is expressed. Thus,

$$\mathrm{II} = 2;\quad \mathrm{XI} = 11;\quad \mathrm{LX} = 60;\quad \mathrm{XXX} = 30.$$

If a letter is written *before* another letter of greater value, the *difference* of their values is expressed. Thus,

IV = 4; IX = 9; XL = 40; XC = 90.

By the Roman method the first 20 numbers are:

I = 1; VI = 6; XI = 11; XVI = 16;
II = 2; VII = 7; XII = 12; XVII = 17;
III = 3; VIII = 8; XIII = 13; XVIII = 18;
IV = 4; IX = 9; XIV = 14; XIX = 19;
V = 5; X = 10; XV = 15; XX = 20.

Complete with figures:

XXI = XL = LX = LXI =
XXII = XLI = LXX = LXXXIII =
XXIII = XLIV = LXXX = XCIV =
XXVI = XLV = XC = XCIX =
XXIX = XLVII = LXV = C =
XXX = XLIX = XCV = L =

Complete with Roman numerals:

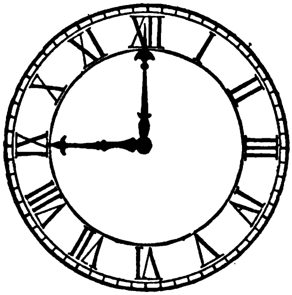
21 = 40 = 60 = 61 = 39 =
22 = 41 = 70 = 72 = 51 =
23 = 42 = 80 = 83 = 59 =
24 = 43 = 90 = 94 = 69 =
25 = 44 = 65 = 77 = 79 =
26 = 45 = 75 = 88 = 89 =
27 = 46 = 85 = 96 = 98 =
28 = 47 = 95 = 99 = 31 =
29 = 48 = 35 = 91 = 36 =

Roman numerals are generally used to number chapters in books and the hours on the faces of clocks.

NOTE.—On a clock-face four is commonly marked IIII.

TIME OF DAY.

When a clock has only two hands, the shorter one is the hour-hand and the longer one is the minute-hand.



1. How many spaces from I to II? From II to III?

2. How many such spaces in the entire circle?

3. The minute-hand passes over one of these spaces every minute; how long does it take the minute-hand to go from XII to I? From I to II? From II to III? To go around the entire circle?

4. This time is also an hour; how many minutes, then, are there in an hour? In ½ of an hour? In ¼ of an hour?

5. How many 5-minute spaces in the large circle?

6. The hour-hand passes over one of these spaces in an hour; how long does it take the hour-hand to go from I to II? From I to III? To go around the entire circle?

7. This time is ½ of a day; how many hours in a day?

8. What time is indicated in the picture?

9. What is the time of day when the minute-hand is at XII and the hour-hand at I? Hour-hand at V? At VII? Where are the hands at five o'clock? At nine?

10. Where are the hands at 10 minutes past three o'clock?

SECTION II.

FUNDAMENTAL PROCESSES.

NUMERATION AND NOTATION.

1. If we desire to know how many trees there are in a certain grove or how many leaves upon their branches, we must count them, thus, *one, two, three, four, five, six, seven, eight, nine,* and so on until all have been counted.

These expressions, *one, two, three, four, five, six, seven, eight, nine,* etc., are called **Numbers.**

2. In writing numbers we use ten characters called **Figures.** Thus,

Figures,	1,	2,	3,	4,	5,	6,	7,	8,	9,	0.
Names,	one,	two,	three,	four,	five,	six,	seven,	eight,	nine,	zero.

3. Numbers greater than nine are expressed by writing two or more of these figures side by side. Thus,

10 = 1 *ten,* called *ten.*
11 = 1 *ten* and 1 *unit,* or *eleven.*
12 = 1 *ten* and 2 *units,* or *twelve.*
13 = 1 *ten* and 3 *units,* or *thirteen.*
14 = 1 *ten* and 4 *units,* or *fourteen.*

And so on to 19, *nineteen.*

20 = 2 *tens,* called *twenty.*
21 = 2 *tens* and 1 *unit,* or *twenty-one.*
22 = 2 *tens* and 2 *units,* or *twenty-two.*

And so on to 29, *twenty-nine.*

In like manner we have 30, 40, 50, 60, 70, 80, 90, with the intervening numbers.

How many tens and units in—

16? 45? 92? 43? 49?
19? 21? 77? 34? 54?
17? 30? 80? 73? 88?
10? 56? 12? 37? 29?
27? 40? 75? 63? 50?
53? 67? 79? 84? 91?

In reading a number consisting of tens and units the tens and units are read together. Thus, 53 is read "fifty-three."

Read the following:

18 35 40 22 17 89
81 53 60 33 71 98
27 67 80 66 19 75
72 76 90 77 91 57
55 68 79 83 95 99

A figure standing in the third place expresses **Hundreds.** Thus,

100 = 1 *hundred,* called *one hundred.*
234 = 2 *hundred,* 3 *tens,* 4 *units,* or *two hundred and thirty-four.*
999 = 9 *hundred,* 9 *tens,* 9 *units,* or *nine hundred and ninety-nine.*

How many units, tens, and hundreds in—

123? 456? 789? 371? 908?
321? 676? 897? 111? 879?
132? 405? 760? 222? 642?
312? 918? 600? 450? 476?
147? 285? 307? 890? 999?

In reading a number of three places the hundreds, tens, and units are read together. Thus, 342 is read *three hundred and forty-two.*

Read the following:

123	456	109	700	789
231	564	230	780	978
312	645	405	909	879

4. **Periods.**—For convenience in reading and writing numbers the figures of a number are divided into periods of three places each.

The first three places make the *first* or *units period;* the second three places, the *second* or *thousands period,* etc.

5. The names of the first three periods are given in the following

NUMERATION TABLE.

NAMES OF PERIODS,	Millions.			Thousands.			Units.		
NAMES OF PLACES,	Hundred-millions,	Ten-millions,	Millions,	Hundred-thousands,	Ten-thousands,	Thousands,	Hundreds,	Tens,	Units,
PLACES,	4	6	8,	2	5	6,	7	8	6
PERIODS,	3D.			2D.			1ST.		

The periods are separated from each other by commas.

Each period except the highest *must* have three figures.

6. Drill on the Table.

1. Name the places in order from units to millions.

2. Name the periods in order from units to millions.

3. Name the places in order from millions to units.

4. Name the periods in order from millions to units.

5. Name the 1st period. 2d period. 3d period.

6. In what period are millions? Units? Thousands? Ten-millions? Hundreds?

Read the following:

1.	*2.*	*3.*	*4.*	*5.*
1,000	3,200	1,020	8,008	3,216
2,000	4,300	2,030	6,006	8,314
3,000	6,500	3,040	4,005	7,816
4,000	7,800	4,040	7,001	9,232
6,000	8,500	6,070	9,002	4,711
9,000	5,300	8,090	4,003	9,086

6.	*7.*	*8.*	*9.*	*10.*
10,000	12,000	12,416	64,040	99,009
30,000	24,000	18,026	80,800	52,007
60,000	62,000	32,418	19,008	82,160
80,000	73,000	86,040	23,202	47,005

11.	*12.*	*13.*	*14.*
200,000	205,000	208,208	123,456
300,000	308,000	407,407	654,321
800,000	409,000	507,507	909,009
900,000	501,000	517,816	806,060

15.	*16.*	*17.*	*18.*
1,000,000	3,416,000	22,000,000	16,204,000
2,000,000	8,000,172	42,000,000	25,260,184
4,000,000	9,400,183	94,000,000	45,002,062
6,000,000	8,400,400	86,000,000	47,316,814

Write in figures—

1. One hundred and sixteen.
2. Nine hundred and seven.
3. Four thousand, one hundred, and ten.
4. Six thousand, two hundred, and six.
5. Two thousand, four hundred, and twenty.
6. Sixteen thousand, five hundred.
7. Ninety-two thousand, six hundred.
8. Forty-three thousand, one hundred.
9. Three hundred and fourteen thousand.
10. Nine hundred and sixty-four thousand.
11. Four million. Six million.
12. Ten million. Forty million.
13. Six million, six thousand, and six.
14. Eight million and eight.
15. Nine million, nine hundred thousand.
16. Four million, five thousand, and six.
17. 45 million, 30 thousand, 200 units.
18. 125 million, 600 thousand, 316 units.
19. 900 million, 9 thousand, 408 units.
20. 999 million, 999 thousand, 999 units.

UNITED STATES MONEY.

7.—*1.* Name the coin of least value in United States money.

2. How many cents in a dollar?

3. How many cents in a half dollar?

4. How many cents in a quarter dollar?

The dollar is indicated by the symbol $, called the *dollar sign*, which is written before the number of dollars. Thus, two dollars is written $2, or $2.00.

5. Write four dollars both ways, using the dollar sign.

6. Write five dollars. Six dollars. Ten dollars.

Fifteen dollars and twenty-five cents is written $15.25. The dot between the 5 and the 2 is called the *decimal point.* The two figures on the right of the decimal point express cents, and the figures on the left express dollars.

7. How many places do cents occupy?

Read—

8.	*9.*	*10.*	*11.*
$1.25	$10.30	$125.63	$118.07
$2.50	$62.75	$245.75	$200.50
$5.00	$85.25	$405.40	$1000.00
$8.75	$50.00	$714.02	$9025.75

Write in figures—

12. 8 dollars and 25 cents.
13. 16 dollars and 50 cents.
14. 20 dollars and 75 cents.
15. 50 dollars and 85 cents.
16. 84 dollars and 5 cents.
17. 125 dollars and 6 cents.
18. 200 dollars and 4 cents.
19. 100 dollars and 1 cent.
20. 400 dollars and 33 cents.
21. 1200 dollars and 62 cents.
22. One hundred and five dollars and five cents.
23. Two thousand dollars and eight cents.

DEFINITIONS.

8. **Arithmetic** treats of numbers and their uses.

A **Unit** is one of any kind.

A **Number** is a unit or a collection of units.

An **Integer** is a whole number; as, 5, 12, 25, etc.

9. **Notation** is the art of writing numbers.

Numeration is the art of reading numbers.

ADDITION.

ORAL EXERCISES.

10.—*1.* A farmer had 7 sheep and bought 4 more; how many did he then have?

2. Harry has $6 and Lawrence has $5; how many dollars do they both have?

3. Arthur is 9 years old and Horace is 6; what is the sum of their ages?

4. I paid $6 for a barrel of flour and $7 for a ton of coal; what did they both cost?

5. There are 6 boys and 8 girls in a class; how many pupils are there?

6. Ross is 5 years old and his sister is 9 years older; what is the age of his sister?

7. A boy spent 8 cents for candy and 7 cents for fruit; how much did he spend for both?

8. A farmer had 9 cows and bought 7 more; how many did he then have?

9. John has 8 apples and William has 9; how many do they both have?

10. Mary picked 9 quarts of berries and bought 9 more; how many quarts did she then have?

11. How many are—

4 and 7?
6 and 8?
8 and 3?
9 and 6?
5 and 9?
8 and 5?
7 and 6?
7 and 8?
7 and 7?
7 and 9?
9 and 4?
7 and 5?
8 and 8?
9 and 8?
9 and 9?

12. Add by 2's from 0 to 60. Thus, 0, 2, 4, 6, etc.
13. Add by 2's from 1 to 61. From 70 to 90.
14. Add by 3's from 0 to 63. From 1 to 64.
15. Add by 3's from 2 to 65. From 60 to 75.

16. Add by 4's from 0 to 60. From 1 to 61.

17. Add by 4's from 2 to 62. From 3 to 63.

18. Add by 5's from 0 to 100. From 1 to 61.

19. Add by 5's from 2 to 62. From 3 to 63.

20. A man traveled 5 miles the first hour, 8 miles the second, and 9 miles the third; how far did he travel?

21. Harold has 7 cents, James 8, and Harry 9; how many cents do they together have?

22. A farmer paid $6 for a sheep, $9 for a plow, and $8 for a rake; what did they all cost?

23. A hat cost $5, a coat $8, and a vest $7; what was the cost of the three articles?

24. There are 5 birds on one tree, 8 on another, and 10 on another; how many birds are there on the three trees?

25. Add by 6's from 0 to 72. From 1 to 73.

26. Add by 6's from 2 to 74. From 3 to 75.

27. Add by 7's from 0 to 70. From 1 to 71.

28. Add by 7's from 2 to 72. From 3 to 73.

29. Add by 8's from 0 to 72. From 1 to 73.

30. Add by 8's from 2 to 74. From 3 to 75.

31. Add by 9's from 0 to 72. From 1 to 73.

32. Add by 9's from 2 to 74. From 3 to 75.

33. Add by 10's from 0 to 100. From 1 to 101.

34. Add by 10's from 2 to 102. From 3 to 103.

35. Add by 10's from 4 to 104. From 5 to 105.

SIGHT DRILL.

In the following exercises give the results only.

36. Add 2 to each of the following numbers:

2,	4,	6,	8,
3,	5,	7,	9,
8,	6,	4,	2,
9,	7,	5,	3,

Add 3 to each of the foregoing numbers. Add 4. Add 5. Add 6. Add 7. Add 8. Add 9. Add 10. Add 11. Add 12. Add 13. Add 14. Add 15. Add 16. Add 17.

37. To the following numbers,

1,	7,	14,	21,	27,	34,
2,	8,	15,	22,	28,	35,
3,	9,	16,	23,	29,	36,
4,	11,	17,	24,	31,	37,
5,	12,	18,	25,	32,	38,
6,	13,	19,	26,	33,	39,

add 2, 3, 4, 5, 6, 7, 8, 9, separately, to each number in column, then to each number in line.

WRITTEN EXERCISES.

CASE I.

11. **To add when the sum of no column is more than nine.**

1. Find the sum of 231, 124, and 343.

PROCESS.

$$\begin{array}{r} 231 \\ 124 \\ \underline{343} \\ 698 \end{array}$$ *Ans.*

We write the numbers so that units shall form the first column, tens the second column, and hundreds the third column.

We begin at units to add, naming the results only; thus, 3, 7, 8. Write 8 under the units column.

Then add the tens, 4, 6, 9. Write 9 under the tens column.

Lastly, add the hundreds, 3, 4, 6. Write 6 under the hundreds column.

PROOF.—The work may be proved by adding from the top down. If the two results agree the work is probably correct.

Add—

2.	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*
1	2	5	1	2	2	7
3	3	2	2	3	4	1
5	4	1	4	2	3	1

Find the sum of—

9. 1, 2, 2, and 4.
10. 4, 1, 2, and 2.
11. 3, 2, 1, and 3.
12. 2, 1, 2, and 3.
13. 2, 1, 3, and 3.
14. 3, 1, 2, and 2.
15. 2, 3, 1, and 3.
16. 2, 2, 1, and 3.
17. 5, 1, 2, and 1.
18. 1, 6, 1, and 1.

19.	*20.*	*21.*	*22.*	*23.*	*24.*
21	12	13	43	12	31
14	41	32	10	31	22
32	35	42	42	52	36

25.	*26.*	*27.*	*28.*	*29.*
121	163	432	116	412
312	512	234	551	213
243	321	321	312	351

30.	*31.*	*32.*	*33.*	*34.*
216	413	217	614	102
501	212	151	141	503
172	172	631	222	182

35.	*36.*	*37.*	*38.*	*39.*
$1202	$4325	$1230	$4216	$1205
4153	1231	3024	1261	3042
1632	3213	5632	2402	5772

40.	*41.*	*42.*	*43.*
$321.43	$112.14	$372.05	$170.32
113.41	420.31	202.71	303.21
143.02	316.12	113.12	314.02
312.13	131.21	101.01	112.12

44. 1302, 4321, 2213, and 1101.
45. 6021, 403, 1341, and 2002.

46. 1402, 6200, 1115, and 1231.

47. 12012, 2172, 23011, and 503.

48. 1321, 4225, 10, and 132.

49. 1232, 4302, 1133, and 2321.

50. 123, 4321, 122, and 2113.

51. 34123, 31213, 14311, and 20341.

52. 12131, 41211, 21613, and 13024.

53. 112, 13214, 1140, and 23020.

54. John is 12 years old, Henry is 31 years old, and their father is 54 years old; what is the sum of these ages?

55. A owns 312 acres of land, B 253 acres, and C 314 acres; how many acres do they together own?

56. A horse cost $212, a carriage $161, and a set of harness $102; what did they all cost?

57. There are three piles of grain: the first contains 1204 bushels, the second 4120 bushels, and the third 301 bushels; how many bushels in the three piles?

58. There are three books: the first contains 1020 pages, the second 624 pages, and the third 1122 pages; how many pages in the three books?

59. A farmer owns four farms: the first contains 116 acres, the second 3420 acres, the third 1201 acres, and the fourth 212 acres; how much land does he own?

60. A set of dishes cost $20.12, a cupboard $31.25, and a chair $7.50; what was the entire cost?

61. There are three purses of money: the first contains $100.75, the second $1043.10, and the third $624.14; how much money in the three purses?

62. Find the sum of three hundred and twenty-one, two hundred and thirty-three, and one hundred and twenty-three.

63. Find the sum of one thousand and twenty-one, three hundred and thirteen, four thousand one hundred and twenty-one, one thousand four hundred and thirty-two, and two thousand and twelve.

64. Find the sum of one thousand and twenty-two, four thousand two hundred and six, 2130, and one thousand four hundred and twenty-one.

65. Find the sum of one hundred and thirty-two dollars and twenty-five cents, three hundred and four dollars and thirty cents, four hundred and twenty-one dollars and twenty cents.

CASE II.

12. To add when the sum of any column is more than nine.

13. First.—*To add a single column.*

1. What is the sum of 6, 7, and 9?

PROCESS.

6
7
9
22, *Ans.*

We write the numbers in a column and add, naming results only; thus, 9, 16, 22. We write the sum below the line.

Add—

2.	*3.*	*4.*	*5.*	*6.*	*7.*
6	4	1	4	2	6
3	5	6	8	6	5
2	3	7	7	8	7

8.	*9.*	*10.*	*11.*	*12.*	*13.*
4	3	2	6	4	8
5	4	7	7	6	3
6	5	8	8	7	7
7	6	5	9	8	6

14.	*15.*	*16.*	*17.*	*18.*	*19.*
4	3	3	9	6	3
7	4	5	8	7	4
8	5	7	7	9	6
6	6	4	6	2	5
5	7	2	5	5	1

Find the sum of—

20. 4, 6, 2, 7, 5, and 4.
21. 3, 5, 7, 9, 4, and 6.
22. 4, 5, 3, 2, 6, and 5.
23. 4, 2, 3, 4, 5, and 3.
24. 6, 5, 4, 3, 2, and 4.
25. 4, 5, 6, 7, 2, and 3.
26. 3, 8, 4, 2, 6, and 2.
27. 4, 5, 6, 7, 8, and 9.
28. 2, 3, 4, 5, 6, and 7.
29. 1, 2, 3, 4, 5, and 6.
30. 1, 3, 5, 7, 9, and 1.
31. 4, 7, 9, 8, 3, and 6.
32. 1, 5, 4, 6, 3, and 2.
33. 2, 5, 7, 9, 1, and 3.
34. 4, 2, 6, 8, 1, and 4.
35. 2, 3, 5, 7, 4, and 3.
36. 6, 5, 4, 3, 2, and 3.
37. 3, 8, 5, 4, 7, and 4.
38. 8, 8, 8, 8, 8, and 8.
39. 9, 9, 9, 9, 9, and 9.
40. 7, 7, 7, 7, 7, and 7.
41. 8, 9, 8, 9, 8, and 9.
42. 2, 3, 4, 5, 6, 7, 2, and 3.
43. 2, 4, 6, 8, 9, 3, 4, and 5.
44. 6, 2, 3, 8, 4, 5, 6, and 2.
45. 4, 3, 2, 6, 8, 4, 4, and 3.
46. 2, 9, 4, 5, 8, 7, 8, and 9.

14. Second.—*To add several columns.*

1. Find the sum of 65 and 87.

PROCESS.

$$\begin{array}{r} 65 \\ \underline{87} \\ 152, \textit{Ans.} \end{array}$$

We write the numbers so that units shall form the first column and tens the second column.

The sum of 7 units and 5 units is 12 units, which equals 1 *ten* and 2 *units.* We write the 2 units under the column of units and add the 1 ten to the column of tens.

The sum of 1 ten, 8 tens, and 6 tens is 15 tens, which we write in the result.

SOLUTION IN PRACTICE.

2. Find the sum of 465, 789, and 347.

PROCESS.

$$\begin{array}{r} 465 \\ 789 \\ \underline{347} \\ 1601, \textit{Ans.} \end{array}$$

In practice we name *results* only in adding; thus, we say 7, 16, 21; write 1 and carry 2 to next column.

Then 2, 6, 14, 20; write 0 and carry 2.

And 2, 5, 12, 16; write 16.

Add—

3.	*4.*	*5.*	*6.*	*7.*	*8.*
57	56	82	76	94	49
64	75	49	88	57	58

9.	*10.*	*11.*	*12.*	*13.*	*14.*
42	36	63	42	81	32
87	57	89	59	17	63
56	34	56	63	94	74

15.	*16.*	*17.*	*18.*	*19.*	*20.*
713	424	763	708	572	816
254	653	415	592	643	398
423	718	576	654	437	561

21.	*22.*	*23.*	*24.*	*25.*	*26.*
364	518	461	167	555	482
582	819	895	845	666	555
649	573	374	375	777	463
432	345	604	216	888	605

27.	*28.*	*29.*	*30.*	*31.*	*32.*
624	416	776	821	624	186
563	718	555	149	375	712
481	193	675	563	542	321
186	546	432	718	346	567
342	806	340	617	802	340

33.	*34.*	*35.*	*36.*	*37.*	*38.*
123	642	432	416	982	984
456	357	456	863	303	201
789	806	863	542	132	222
102	193	132	634	333	654
314	347	567	182	456	321

39.	*40.*	*41.*	*42.*	*43.*
1224	1567	6532	6543	6541
6875	8650	6457	2107	6075
4309	1075	3754	5784	1875
6543	4865	6372	3216	6715
3672	6572	6507	4543	4080

44.	*45.*	*46.*	*47.*	*48.*
2321	5762	9543	1872	6212
6854	1465	6217	8880	3007
3216	3782	8756	7007	425
7189	6543	5432	9165	7864
1254	7182	7562	4321	3240

49.	*50.*	*51.*
46217	54326	63215
68574	86543	47682
43678	62045	36784
65715	65437	52317
43280	12345	12314

52.	*53.*	*54.*	*55.*
$42.15	$120.80	$162.43	$157.82
16.25	146.15	82.65	167.67
86.43	42.16	6.75	6.05
15.67	8.78	10.14	416.35
120.05	165.73	67.18	182.40

56. Add 2185, 7564, 3216, 4214, and 2167.
57. Add 21675, 46215, 86451, and 32865.
58. Add 8162, 7865, 321, 8544, and 6702.
59. Add $24.18, $5.06, $76.43, and $198.43.
60. Add $126.82, $872.42, $564.75, and $8.47.
61. Add $47.82, $6.45, $8.80, $4, and $0.06.

PRACTICAL PROBLEMS.

1. A farmer raised 468 bushels of wheat, 569 bushels of corn, 1256 bushels of potatoes, and 1564 bushels of oats; how many bushels did he raise?

2. A has $6243, B $5384, C $561, and D $4672; how much do they together have?

3. A lady paid $9.75 for a hat, $8.50 for a cloak, and $12.25 for a dress; what was the entire cost?

4. A farmer bought three horses: the first cost $175, the second $260, and the third $316; what did he pay for the three horses?

5. A merchant owes one creditor $647, another $5786, another $687, and a fourth $4780; how much does he owe the four creditors?

6. A man built a house, barn, and shed: he used 10562 bricks for the house, 8760 for the barn, 4687 for the shed, and had 6587 remaining; how many bricks did he buy?

7. A bought five loads of coal: the first weighed 2416 pounds, the second 2384 pounds, the third 2508 pounds, the fourth 2367 pounds, and the fifth 2086 pounds; find the entire weight.

8. In a merchant's store the dry goods are worth $5862, the hardware $6428, the groceries $687, the glassware $1232, and the remainder of the stock $7802; what is the value of the entire stock?

9. A's barn cost $3670.25, his farm $15862, and the farming implements $1865.50; what did they all cost?

10. A man left his oldest son $35862, his next son $34387, his third son $15687, and his wife $65420; what was the value of the entire estate?

11. A's suit of clothes cost him $57.87, his overcoat $35.45, his shoes $9.25, and his hat $6.75; what did the entire outfit cost?

12. A salesman travelled 316 miles on Monday, 208 miles on Tuesday, 198 miles on Wednesday, 176 miles on Thursday, 219 miles on Friday, and 322 miles on Saturday; how far did he travel during the week?

13. A merchant sold $468.27 worth of goods in January, $562.43 worth in February, $675.87 worth in March, and $786.70 worth in April; what was the amount of his sales in the four months?

14. A bought a house for $5682, another for $6780, a third for $3568, and a fourth for $8675; what did he pay for all?

15. The population of New York in 1890 was 1,515,301, of Chicago 1,099,850, of Philadelphia 1,046,964, of Brooklyn 806,343, and of St. Louis 451,770. What was the total population of these five cities?

16. Find the sum of 402 thousand and 8, 816 thousand 182, 512 thousand 109, 16205, and 60 thousand and 54.

17. At the World's Fair, Chicago, the Administration Building cost $435,000, United States Government Building $400,000, Palace of Mechanical Arts $1,200,000, Liberal Arts Building $1,500,000, and Agricultural Building $618,000; what did they all cost?

18. The ten largest cities of the world are:

	Population.
London	4,201,056
Paris	2,344,550
Peking	1,650,000
Canton	1,600,000
Berlin	1,579,244
New York	1,515,301
Tokio	1,389,684
Vienna	1,364,548
Chicago	1,099,850
Philadelphia	1,046,964

Find their total population.

19.	*20.*	*21.*	*22.*	*23.*
576	891	934	111	123
576	891	934	222	321
576	891	934	333	678
576	891	934	444	876
576	891	934	555	592
576	891	934	666	708
576	891	934	777	877
576	891	934	888	942
576	891	934	999	249

24.	*25.*	*26.*	*27.*	*28.*
40618	62147	11111	67891	76215
81620	3607	22222	32108	12673
99999	92045	33333	41767	47625
30609	10708	44444	58232	41263
41628	83879	55555	47620	82134
71540	91409	66666	52379	6754
81762	47061	77777	89765	58764
70695	16778	88888	10234	30124
88888	21297	99999	99999	88888
32539	22222	4176	11111	54321

29.	*30.*	*31.*	*32.*	*33.*
19191	123456	132167	12345	32167
28282	543216	243762	6764	3216
37373	123456	405432	40326	80765
46464	654321	786678	27	432
55555	789078	156792	20326	6753
64646	870987	474327	6764	216
73737	640315	864321	12345	78623
82828	487632	987654	44444	42
91919	989898	321675	88888	9154
31416	101523	334221	4253	5126

34. Copy the following problem and add the numbers across the page, placing the results in the spaces provided for them, and then find the total by adding these results:

9327	4216	8621	. . .
216	4012	87	. . .
65	472	1234	. . .
4863	1357	8062	. . .
170	562	810	. . .
8045	9261	47	. . .
154	7206	9811	. . .
5432	2065	84	. . .
		Total,	. . .

35. In the 34th problem add the columns, and then find the total by taking the sum of these results. Do they agree?

ORIGINAL PROBLEMS.

Let the pupils now make and solve problems of their own, similar to the following:

1. Find the number of pupils in school by adding the number of girls to the number of boys.

2. Find the sum of the ages of any number of pupils. Let each one give his age.

3. Measure the length and width of the school-room, and find the distance around it.

4. Measure the length and width of the school-yard, and find the distance around it.

5. Estimate the height of five of the tallest trees near the school-house, and find the sum of their heights.

6. Find the number of pages in each book used in class, and find the sum.

7. Find the population of the five largest cities in your State.

8. How much money will it take to give each pupil in class $10.25?

DEFINITIONS.

15. **Addition** is the process of finding the *sum* of two or more numbers.

The **Sum** of two or more numbers contains as many units as the numbers added.

16. The **Sign of Addition** is +, called *plus*. It indicates that the numbers between which it is placed are to be added. Thus, 4 + 6 is read 4 *plus* 6, and indicates that 6 is to be added to 4.

17. The **Sign of Equality** is =, and is read *equals*. Thus, 10 = 4 + 6 is read 10 *equals* 4 *plus* 6.

SUBTRACTION.

ORAL EXERCISES.

18.—*1.* In a class of 14 pupils 8 are boys; how many are girls?

2. A boy paid 13 cents for a slate and pencil; what did the slate cost if the pencil cost 4 cents?

3. Ross had 16 pieces of candy and gave 7 of them away; how many had he left?

4. Mary paid 14 cents for oranges and apples, paying 6 cents for the apples; what did the oranges cost?

5. John is 17 years old and his brother is 8 years younger; what is his brother's age?

6. A boy had 18 papers and sold 9 of them; how many were left?

7. A lady had 15 hens and lost 7 of them; how many remained?

8. A had 17 horses and sold 9 of them; how many had he remaining?

9. Arthur had 16 marbles and lost 9 of them; how many remained?

10. What is—

12 minus 4?
13 minus 7?
15 minus 7?
18 minus 9?
16 minus 8?

15 − 8?
16 − 7?
17 − 8?
14 − 9?
13 − 6?

16 minus 6?
14 minus 7?
13 minus 5?
14 minus 6?
17 minus 9?

11. Subtract by 2's from 24. Thus, 24, 22, 20, etc.
12. Subtract by 2's from 23. From 40 to 20.
13. Subtract by 3's from 27. From 26. From 25.
14. Subtract by 4's from 28. From 29. From 30.
15. Subtract by 5's from 50. From 61. From 62.
16. Subtract by 6's from 36. From 37. From 38.
17. Subtract by 7's from 35. From 36. From 37.
18. Subtract by 8's from 32. From 33. From 34.
19. Subtract by 9's from 36. From 37. From 38.
20. Subtract by 10's from 100. From 99. From 98.

Sight Drill.

21. Subtract each of the following numbers,

2,
3,
8,
9,

4,
5,
4,
7,

6,
7,
6,
5,

8,
9,
2,
3,

from 10, 13, 11, 12, 14, 15, 16, 17, 20, 18, and 19, naming the results only.

WRITTEN EXERCISES.

CASE I.

19. To subtract when no term of the subtrahend is greater than the corresponding term of the minuend.

1. Subtract 35 from 98.

PROCESS.

Minuend, 98
Subtrahend, 35
Difference, 63, *Ans.*

We write the less number under the greater, with units under units and tens under tens.

5 units from 8 units leave 3 units, which we write under the units.

3 tens from 9 tens leave 6 tens, which we write under the tens.

PROOF.—Add the difference to the subtrahend; if the sum is equal to the minuend, the work is correct.

Thus, 63 + 35 = 98, the minuend; hence the result is correct.

Subtract—

2.	*3.*	*4.*	*5.*	*6.*	*7.*
97	85	76	58	79	67
62	43	52	25	34	37
35					

8.	*9.*	*10.*	*11.*	*12.*	*13.*
47	58	94	85	96	75
23	33	61	72	64	50

14.	*15.*	*16.*	*17.*	*18.*	*19.*
475	387	988	984	542	682
252	156	367	653	341	562

20.	*21.*	*22.*	*23.*	*24.*
68458	67438	86432	98675	67854
21457	21335	75321	72341	43212

25.	*26.*	*27.*
7765432	9713267	8765439
6204012	7102145	6213216

Subtract—

28. 328 from 929.
29. 284 from 697.
30. 360 from 862.
31. 286 from 8396.
32. 841 from 941.
33. 465 from 8678.

Subtract—

34. 172 from 895.
35. 273 from 483.
36. 975 from 999.
37. 47 from 3298.
38. 1235 from 3897.
39. 637 from 9897.

40.	*41.*	*42.*	*43.*
$126.87	$850.75	$9860.67	$976.32
14.60	240.31	4320.45	154.30

44.	*45.*	*46.*	*47.*
$457.55	$476.63	$1264.37	$948.36
134.32	123.41	151.12	117.21

48. A boy had 87 cents and spent 45 cents for candy; how much had he remaining?

49. A farmer had 876 sheep and sold 346 of them; how many remained?

50. A man bought a horse for $325 and sold him for $225; how much did he lose?

51. A man bought a horse for $321 and sold him for $435; how much did he gain?

52. A farm was bought for $8650 and sold for $9780; what was the gain?

53. An army went into battle with 5786 men, and came out with only 1422 men; how many were missing?

54. A man's income for a year is $2456; how much does he save if his expenses are $1223?

55. A man was born in 1841 and died in 1893; how old was he?

56. The population of a town ten years ago was 8297, now it is 18,998; what was the gain in ten years?

57. A grain-dealer bought 6780 bushels of wheat and sold 5260 bushels; how many had he remaining?

58. The expenses of a company for one year were $152,476.37, and the income for the same time was $273,698.89; what was the annual gain?

59. The expenses of a firm for one year were $94,375.80, and the income for the same time was $84,321.60; did the firm gain or lose, and how much?

CASE II.

20. To subtract when a term in the subtrahend is greater than the corresponding term in the minuend.

1. Subtract 26 from 83.

PROCESS.
Minuend, 83
Subtrahend, 26
Difference, 57, *Ans.*

Since we cannot take 6 units from 3 units, we add 10 units to the 3 units, making 13 units; 6 units from 13 units leave 7 units, which we write under the units column.

To balance the 10 units added to the minuend, we add 10 units or 1 ten to 2 tens, making 3 tens; 3 tens from 8 tens leave 5 tens, which we write under the tens column.

PROOF.—57 + 26 = 83, the minuend; hence the result is correct.

2. Subtract 387 from 625.

PROCESS.
Minuend, 625
Subtrahend, 387
Difference, 238, *Ans.*

In practice it is customary to say:
7 from 15 leaves 8;
9 from 12 leaves 3;
4 from 6 leaves 2.

3.	*4.*	*5.*	*6.*	*7.*	*8.*
42	52	62	72	82	95
15	26	37	48	39	27
27					

9.	*10.*	*11.*	*12.*	*13.*	*14.*
643	552	461	863	961	943
218	324	245	125	429	827

15.	*16.*	*17.*	*18.*	*19.*	*20.*
523	642	343	397	456	507
215	351	185	186	375	263

21.	*22.*	*23.*	*24.*	*25.*	*26.*
572	743	605	520	400	800
385	275	427	234	135	311

27.	*28.*	*29.*	*30.*	*31.*
$281.16	$864.28	$572.38	$810.70	$42.20
175.08	275.37	212.22	128.20	18.62

32.	*33.*	*34.*	*35.*
50000	80000	60000	70000
12861	23712	28654	25672

36.	*37.*	*38.*	*39.*	*40.*
$4000	$300.90	$9000	$11000	$16000
1001	101.01	406	1010	2020

41.	*42.*	*43.*	*44.*
80640	90062	101010	80081
31056	70809	90909	29999

Find the difference between—

45. 784 and 257.
46. 582 and 278.
47. 985 and 787.
48. 821 and 617.
49. 922 and 666.
50. 8214 and 2234.
51. 4000 and 1826.
52. 8621 and 4000.
53. 8008 and 2671.
54. 8765 and 2851.
55. 80605 and 23456.
56. 20086 and 10875.
57. 98004 and 31232.
58. 27040 and 4625.
59. 47086 and 9276.
60. 45620 and 9009.
61. 341682 and 200576.
62. 900812 and 216318.

Perform the operation indicated:

63. 43217 – 21675.
64. 80000 – 43102.
65. 72186 – 26785.
66. 81234 – 27532.
67. 100000 – 98213.
68. 6432187 – 326872.
69. 430170 – 216897.
70. 100000 – 111.

PRACTICAL PROBLEMS.

1. John had 85 cents and spent 28 cents; how much had he remaining?

2. Mary had 93 cents and bought a piece of ribbon for 37 cents; how much money had she remaining?

3. Anna had 75 pins and gave away 48 of them; how many had she remaining?

4. Two boys picked 84 quarts of berries; how many did the second boy pick if the first boy picked 55 quarts?

5. John wrote 475 words on Monday and 387 on Tuesday; how many more did he write on Monday than on Tuesday?

6. James had 125 marbles and gave away 47 of them; how many remained?

7. A horse was bought for $325 and sold for $278; what was the loss?

8. Ruth and May gathered 134 flowers; how many did Ruth gather if May gathered 57?

9. Washington died in 1799 at the age of 67; in what year was he born?

10. Daniel Webster was born in 1782 and died in 1852; how old was he at his death?

11. Henry Clay was born in 1777 and died in 1852; how old was he at his death?

12. A farm was bought for $8450 and sold for $9000; what was the gain?

13. An army of 5000 men lost 2163 men; how many remained?

14. By selling my house for $4217 I gained $329; what did I pay for it?

15. What number added to 1863 will make 3867?

16. Mr. Smith bought 7560 feet of lumber and used 5227 feet; how much remained?

17. A had $5000 in bank and drew out $3218; how much remained in bank?

18. A man died in 1893 at the age of 96 years; when was he born?

19. At an election Mr. Noble received 45216 votes and his opponent received 23580 votes; what was Mr. Noble's majority?

20. A miller bought 9876 bushels of grain, but before it was sold 2350 bushels spoiled; how many bushels remained for sale?

21. Mt. St. Elias is 18,010 feet high and Pike's Peak is 14,147 feet high; what is the difference in height?

22. How many years is it since Columbus discovered America in 1492?

23. A firm earned $20160, and its expenses were $16285; what was the gain?

24. A drover had 9325 cattle and sold 6578; how many remained?

PRACTICAL PROBLEMS

In Addition and Subtraction.

21.—*1.* What is the value of 521 + 337 + 482 — 787?

2. What is the value of 476 + 582 + 347 — 808?

3. What is the value of 1001 + 387 + 62 — 804?

4. How many are 386 — 275 + 438 — 375?

5. How many are 821 — 347 — 270 + 421?

6. How many are 1008 — 476 + 2162 — 387?

7. A boy bought a book for 65 cents and a slate for 25 cents; how much change should he receive out of a dollar?

8. A lady bought a hat for $5.75 and a shawl for $3.15; if she pays for them with a 10-dollar bill, how much change should she receive?

9. I bought a hat for $6.25, a coat for $10.50, and a vest for $7.15: I gave the clerk $25; how much change should I receive?

10. A house was bought for $3325, $125 were paid for repairs: it was afterward sold for $3750; what was the gain?

11. A teacher's salary is $1500 a year: he pays $375.25 for his board, $85.60 for clothing, and $215.15 for other expenses; how much does he save?

12. A farmer receives $415 for his wheat, $216 for his corn, and $167 for his potatoes: he paid $221 rent, $75 for labor, and $163 for other expenses; how much did he save?

13. A paid $8000 for his farm, $7365 for his house, and $762 for his barn, and sold them for $18000; what was his gain?

14. A farmer paid $45 for a cow, $275 for a horse, and $215 for a wagon; how much did he gain if he sold the cow for $50 and the horse and wagon for $500?

15. How many are $12345 + 36215 - 42365 + 26004 - 28437 + 12516 - 437$?

ORIGINAL PROBLEMS.

1. Find the difference between the distance around the school-yard and the distance around the school-house.

2. Find the difference between the sum of two sides of the school-yard and the distance between the opposite corners.

3. Estimate the heights of two trees, and then find the difference in height.

4. Find the difference between the number of pages in your reader and the number of pages in this arithmetic.

5. Find the difference between the population of the largest city in your State and the one next in size.

DEFINITIONS.

22. Subtraction is the process of taking a less number from a greater.

The **Minuend** is the number from which we subtract.

The **Subtrahend** is the number to be subtracted.

The **Difference** is the result obtained by subtracting.

23. The **Sign of Subtraction** is —, and is read *minus*. When it is placed between two numbers it indicates that the number after it is to be subtracted from the number before it. Thus, 8 — 5 = 3 is read 8 *minus* 5 *equals* 3.

MULTIPLICATION.

ORAL EXERCISES.

24.—*1.* What will 4 apples cost at 5 cents apiece?

2. What will 5 pears cost at 4 cents apiece?

3. What will 5 slates cost at 6 cents apiece?

4. What will 6 cards cost at 5 cents apiece?

5. What will 7 sheep cost at $6 apiece?

6. What will 6 calves cost at $7 apiece?

7. What will 8 yards of cloth cost at $9 a yard?

8. What will 9 melons cost at 8 cents apiece?

9. What will 9 quarts of berries cost at 9 cents a quart?

10. A boy earns $9 a month; how much will he earn in 7 months?

11. At 6 cents apiece, what will 9 slates cost?

12. At $9 each, what will 5 coats cost?

13. At $8 apiece, what will 7 shawls cost?

14. A dime is 10 cents; how many cents in 7 dimes? 8 dimes? 6 dimes? 9 dimes?

15. What will 8 pounds of sugar cost at 8 cents a pound?

16. How many days in 7 weeks?

17. How many working days in 8 weeks?

18. How many school days in 9 weeks?
19. How many months in 5 years? 6 years?
20. Repeat the table of 4's. Of 5's. Of 6's.
21. Repeat the table of 7's. Of 8's. Of 9's.
22. Make and repeat a table of 10's.
23. Make and repeat a table of 11's.
24. Make and repeat a table of 12's.
25. How many are 8 + 8 + 8, or three 8's?
26. How many are 7 + 7 + 7 + 7, or four 7's?
27. How many are 6 + 6 + 6 + 6 + 6, or five 6's?
28. How many are 9 + 9 + 9 + 9 + 9 + 9, or six 9's?
29. How many are 5 + 5 + 5 + 5 + 5, or five 5's?

SIGHT DRILL.

30. Multiply each of the following numbers

2, 9, 6, 7, 8,
3, 4, 7, 4, 9,
8, 5, 6, 5, 2,

by 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12, naming results only.

WRITTEN EXERCISES.

CASE I.

25. When the multiplier is one figure.

1. Write 321 three times and add.

ADDITION.

$$\begin{array}{r} 321 \\ 321 \\ \underline{321} \\ 963 \end{array}$$

MULTIPLICATION.

$$\begin{array}{r} 321 \\ \underline{3} \\ 963 \end{array}$$

Since the figures in each column are the same, time is saved by taking 3 times 1 or 3, 3 times 2 or 6, and 3 times 3 or 9. Time is also saved by writing the number to be added but once, and writing the number of times it is taken beneath, as in the margin. This last process is called **Multiplication.**

Multiplication is thus seen to be a short method of addition.

2. Multiply 186 by 4.

Process.
Multiplicand, 186
Multiplier, 4
Product, 744, *Ans.*

We write the multiplier under the units figure of the multiplicand, and begin at the right to multiply.

4 times 6 units are 24 units, or 2 tens and 4 units. We write the 4 units under the column of units and add the 2 tens to the next product.

4 times 8 tens are thirty-two tens, plus the 2 tens are 34 tens, or 3 hundreds and 4 tens. We write the 4 tens under the column of tens and add the 3 hundreds to the next product.

4 times 1 hundred are 4 hundreds, plus the 3 hundreds are 7 hundreds, which we write under the column of hundreds; hence the product is 744.

3. Multiply $3.56 by 7.

Process.
$3.56
7
$24.92, *Ans.*

It is customary in practice to say:

7 times 6 are 42; write the 2 and "carry" the 4. 7 times 5 are 35, and 4 are 39; write the 9 and carry the 3. 7 times 3 are 21, and 3 are 24; write 24. Hence the result is $24.92.

Multiply—

4.	*5.*	*6.*	*7.*	*8.*
24	132	$48	$1.23	$2.42
2	3	3	5	5
48	396	$144	$6.15	$12.10

9. Multiply 134 by 2; by 3; by 4; by 6.
10. Multiply 251 by 2; by 4; by 6; by 8.
11. Multiply $3.21 by 3; by 5; by 7; by 9.
12. Multiply 456 by 4; by 5; by 6; by 7.
13. Multiply 157 by 2; by 4; by 7; by 8.
14. Multiply 723 by 4; by 6; by 7; by 9.
15. Multiply 4021 by 5; by 6; by 8; by 9.
16. Multiply 60204 by 6; by 8; by 9; by 7.
17. Multiply 1249 by 6; by 7; by 8; by 9.
18. Multiply 70809 by 7; by 9; by 8; by 5.
19. Multiply 3456 by 3, and the product by 5.

20. Multiply 5789 by 4, and the product by 6.

21. Multiply 6031 by 3, and the product by 5, and this product by 7.

22. Write 345 nine times and add. Multiply 345 by 9.

PRACTICAL PROBLEMS.

1. What will 5 books cost at 43 cents apiece?

2. If a yard of ribbon costs 56 cents, what will 6 yards cost?

3. When butter is 35 cents a pound, what must you pay for 7 pounds?

4. A man received $2.25 a day for his labor; how much would he receive for 6 days' labor?

5. A drover bought 9 horses at $125 apiece; what did they all cost?

6. How much will 8 tons of coal cost at $5.25 per ton?

7. There are 5280 feet in a mile; how many feet in 6 miles?

8. A farmer bought 7 cows at $41.75 per head; what did he pay for them?

9. Mr. Bowman sold 5 acres of land at $124.25 per acre; how much did he receive for it?

10. There are 160 square rods in 1 acre; how many square rods in 8 acres?

11. What will 5 tons of hay cost at $18.75 per ton?

12. When wood is selling at $6.35 a cord, what must you pay for 7 cords?

13. A man travels 53 miles a day; how far can he travel in 9 days at the same rate?

14. A book contains 316 pages; how many pages in 8 books?

15. When tea is worth 95 cents a pound, what must you pay for 7 pounds?

16. There are 5760 grains in one pound Troy; how many grains in 9 pounds?

17. Multiply 123456789 by 9.

18. Multiply 987654321 by 9.

CASE II.

26. When the multiplier consists of two or more figures.

1. Multiply 348 by 76.

	Process.
Multiplicand,	348
Multiplier,	76
1st partial product,	2088
2d partial product,	2436
Product,	26448, *Ans.*

In this problem we must multiply 348 by 6 units and 7 tens, and then add the partial products.

6 times 348 gives 2088, the first partial product. 7 times 348 gives 2436; and since the multiplier is 7 *tens*, the result is 2436 *tens*, the second partial product. Adding the partial products, we have 26448, the required product.

Proof.—Multiply the multiplier by the multiplicand; if the results agree, the work is probably correct.

The pupil should take care to put the first figure of each product directly under the figure of the multiplier which produced it.

2.	*3.*	*4.*
3467	3467	3467
74	704	7004
13868	13868	13868
24269	24269	24269
256558	2440768	24282868

Multiply—

5. 152 by 13.
6. 346 by 13.
7. 789 by 13.
8. 243 by 14.
9. 567 by 14.
10. 354 by 15.
11. 978 by 15.
12. 321 by 26.
13. 465 by 26.
14. 709 by 26.
15. 651 by 37.
16. 984 by 37.
17. 392 by 81.
18. 1234 by 92.
19. 5698 by 29.
20. 5432 by 45.

21. 7986 by 54.
22. 6504 by 123.
23. 4316 by 134.
24. 8902 by 163.
25. 4869 by 192.
26. 9843 by 203.
27. 1305 by 213.
28. 6087 by 302.
29. 1804 by 415.
30. 46721 by 367.
31. 15409 by 516.
32. 60805 by 615.
33. 23007 by 723.
34. 61095 by 666.
35. 59176 by 809.
36. 73002 by 906.
37. 18095 by 739.
38. 9865 by 1234.
39. 4037 by 2341.
40. 6894 by 9832.

PRACTICAL PROBLEMS.

1. A farm of 97 acres was bought for $187 an acre; what did it cost?

2. What will 123 horses cost at $212 apiece?

3. A bought 234 tons of coal at $5.25 a ton; what was the entire cost?

4. What will 216 bushels of grain cost at $1.12 a bushel?

5. If a barrel of coal oil contains 52 gallons, how many gallons in 98 barrels?

6. There are 365 days in a year; how many days in 235 years?

7. A family uses 45 pounds of flour in one month; how many pounds will be used in 63 months?

8. An army eats 3216 pounds of meat in one day; how many pounds will it eat in 31 days? In 316 days?

9. What will 304 barrels of flour cost at $4.75 a barrel?

10. A merchant bought 327 boxes of oranges at $5.25 per box; what did they cost?

11. There are 125 regiments in an army, each containing 876 men; how many men in the army?

12. At 32 cents a pound, what will 512 pounds of coffee cost?

13. There are 128 cubic feet in one cord of wood; how many cubic feet in 246 cords?

14. There are 1728 cubic inches in one cubic foot; how many cubic inches in 415 cubic feet?

CASE III.

27. When there are zeros at the right of either or both terms.

1. Multiply 4 by 10; by 100; by 1000.
2. Multiply 16 by 10; by 100; by 1000.
3. Multiply 45 by 10; by 100; by 1000.

We can multiply by 10, 100, 1000, etc., by annexing to the multiplicand as many zeros as there are in the multiplier.

If both terms end in zeros, multiply without regard to the zeros, and annex to the product as many zeros as there are at the right of both terms. Thus,

4. Multiply 3460 by 2400, and 31600 by 21000.

Process.

Multiplicand,	3460
Multiplier,	2400
	1384
	692
Product,	8304000

Process.

Multiplicand,	31600
Multiplier,	21000
	316
	632
Product,	663600000

Multiply—

5. 516 by 10.
6. 452 by 100.
7. 385 by 1000.
8. 4126 by 2000.
9. 8614 by 3000.
10. 1234 by 6000.
11. 420 by 40.
12. 250 by 500.
13. 490 by 180.
14. 650 by 230.
15. 9900 by 590.
16. 7900 by 9800.
17. 4300 by 63000.
18. 52600 by 620.
19. 28000 by 800.
20. 42300 by 7200.
21. 162000 by 47000.
22. 62500 by 20500.
23. 40200 by 304000.
24. 4700 by 607000.

25. At 60 cents a bushel, what will 120 bushels of wheat cost?

26. At $1.50 a yard, what will 200 yards of cloth cost?

27. There are 5760 grains in a Troy pound; how many grains in 300 pounds?

28. There are 5280 feet in a mile; how many feet in 3000 miles?

29. There are 2000 pounds in a ton; how many pounds in 47 tons?

30. In a certain county there are 800 teachers, who receive, on an average, $350 a year; what sum will pay the teachers of the county for one year?

31. What must I pay for 120 acres of land at $250 an acre?

PRACTICAL PROBLEMS

In Addition, Subtraction, and Multiplication.

1. A drover bought 42 cows at $21 apiece and 63 sheep at $12 each, and sold them for $2000; how much did he gain?

2. A lady bought 50 yards of cloth. For 22 yards she paid $1.75 a yard, and for the remainder she paid $1.80 a yard; what did it all cost?

3. A farmer took 27 pounds of butter and 42 dozen of eggs to a store; how much did he receive for both if butter was 32 cents a pound and eggs were 23 cents a dozen?

4. What is the value of 8 horses at $182 apiece and 14 cows at $35 each?

5. A merchant sold 54 barrels of apples at $4.75 a barrel, and gained $162 on the sale; what did the apples cost him?

6. A man earns $135 a month, and pays $27.50 a month for board; how much at this rate will he save in 12 months?

7. A farmer has 15 cows worth $32 each, 23 horses worth $163 each, and 16 sheep worth $12 each; what is his entire stock worth?

8. A has $2150 in bank: he draws out $416, and then deposits $218; how much does he then have in bank?

9. A miller made 475 barrels of flour and sold it at $8 a barrel; how much did he gain, if the wheat cost $1560 and other expenses amounted to $842?

10. A man bought 32 cords of wood at $5.25 a cord, and 53 tons of coal at $3.75 a ton; which cost the more, and how much?

11. The earth moves about 19 miles a second; how much farther will it move in 345 seconds than in 120 seconds?

12. If a train travel 30 miles an hour, how far would it go in 7 days of 24 hours each?

13. If a merchant buys wagons at $55 apiece and sells them at $73 apiece, what will he gain on the sale of 112 wagons?

14. B's income is $2400 a year, and his average expenses are $4 a day; what will he save in 365 days, or one year?

15. An agent sold 450 books at $3.75 each; how much did he gain if the books cost him $3 each?

16. A street-car line carried, on an average, 1200 passengers a day; how much did it earn in 365 days, or one year, if each fare was 5 cents?

17. There are 88 Senators and 356 Representatives in the United States Congress, each receiving $5000 a year; how much do they together receive in a year?

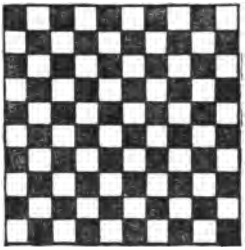
18. There are 60 seconds in a minute, 60 minutes in an hour, and 24 hours in a day; how many seconds in a day?

19. A merchant bought 426 yards of cloth at $4 a yard, and 216 yards of another kind at $6 a yard; how much did he gain if he sold it all at the rate of $5 a yard?

20. Multiply 123456789 by 4, and add to the product the difference between 987654321 and 123456789.

21. I offer a five-dollar bill in payment for 17 pigeons at 25 cents each; how much change should I receive?

ORIGINAL PROBLEMS.



1. How can you find the number of small squares in the large square without counting them singly?

2. How many square inches can be cut from a piece of paper 3 inches long and 3 inches wide?

3. How many square feet in the floor of the school-room?

4. How many square feet in the blackboard?

5. How many square feet in one side of the school-room?

6. How many square inches in a window-pane?

7. How many square inches in the top of your desk?

8. Measure the length and width of this book, and find the number of square inches in the two sides.

9. Measure the length and width of the school-yard, and find the number of square feet in it.

Let the teacher and pupils make other problems of the same kind.

DEFINITIONS.

28. Multiplication is the process of taking one number as many times as there are units in another.

The **Multiplicand** is the number to be multiplied.

The **Multiplier** is the number by which we multiply.

The **Product** is the result obtained by multiplication.

The multiplicand and multiplier are *factors* of the product.

29. The **Sign of Multiplication** is ×, and is read *multiplied by*, or *times*. When placed between two numbers, it shows that the number before it is to be multiplied by the number after it. Thus, $5 \times 3 = 15$, means 5 *multiplied by* 3 *equals* 15.

DIVISION.

ORAL EXERCISES.

30.—*1.* If a quart of milk costs 5 cents, how many quarts can you buy for 15 cents? For 25 cents? For 20 cents?

2. If a pound of sugar costs 6 cents, how many pounds can you buy for 18 cents? For 36 cents? For 54 cents?

3. When coal is selling at $7 a ton, how many tons can you buy for $42? For $49? For $35? For $63?

4. At $8 each how many sheep can be bought for $32? For $48? For $72?

5. A man earns $8 a week; in what time will he earn $56? $64? $40?

6. If 3 hats cost $18, what will one hat cost?

SUGGESTION.—If 3 hats cost $18, one hat will cost one-third of $18, which is $6.

7. If 5 barrels of flour cost $20, what will one barrel cost?

8. If 6 pairs of shoes cost $48, what will one pair cost?

9. If 7 yards of muslin cost 56 cents, what will one yard cost?

10. If 8 sheep cost $56, what will one sheep cost?

11. If 9 quarts of cherries cost 81 cents, what will 1 quart cost?

12. How many times 4 in 24? 4 in 40? 4 in 36? 4 in 32? 4 in 28?

13. How many times 5 in 35? 5 in 45? 5 in 40? 5 in 30? 5 in 25? 5 in 20?

14. How many times 6 in 24? 6 in 36? 6 in 42? 6 in 30? 6 in 48? 6 in 54?

15. How many times 7 in 28? 7 in 42? 7 in 49? 7 in 63? 7 in 56? 7 in 35?

16. How many times 8 in 56? 8 in 64? 8 in 72? 8 in 64? 8 in 48? 8 in 40?

17. How many times 9 in 72? 9 in 81? 9 in 63? 9 in 54? 9 in 45? 9 in 36?

18. At $5 a cord, how many cords of wood can be bought for $45? For $50?

19. If a man can do a piece of work in 56 days, how long will it take 8 men to do the work?

20. William spent 63 cents for berries at 9 cents a quart; how many quarts did he buy?

21. How many weeks of 7 days each are there in 42 days?

22. If a boat can sail 8 miles an hour, how long will it take to sail 80 miles?

SIGHT DRILL.

Divide—

2 into	3 into	4 into	5 into	6 into	7 into	8 into	9 into
12,	12,	16,	25,	54,	35,	40,	90,
20,	15,	32,	40,	60,	63,	56,	54,
14,	30,	40,	50,	72,	84,	72,	72,
16,	24,	48,	60,	66,	56,	96,	99,
22,	27,	44,	55,	48,	70,	88,	63,
24,	36,	36,	45,	42,	49,	64,	45,
18,	21,	28,	35,	36,	42,	56,	108,

naming results only.

23. How many times 6 in 21?

SUGGESTION.—6 is contained in 21 three times, with 3 remaining.

24. How many times 4 in 17? 4 in 22? 4 in 27?

25. How many times 5 in 16? 5 in 22? 5 in 33? 5 in 39? 5 in 47?

26. How many times 6 in 55? 6 in 50? 6 in 45? 6 in 40? 6 in 35?

27. How many times 7 in 36? 7 in 44? 7 in 52? 7 in 60? 7 in 68?

28. How many times 8 in 73? 8 in 65? 8 in 59? 8 in 52? 8 in 47?

29. How many times 9 in 30? 9 in 38? 9 in 48? 9 in 58? 9 in 68?

30. How many times 10 in 41? 10 in 52? 10 in 63? 10 in 74? 10 in 85?

WRITTEN EXERCISES.

SHORT DIVISION.

31.—*1.* Divide 468 by 2.

PROCESS.
Divi-
dend.
Divisor, 2)468
Quotient, 234

2 is contained in 4 2 times; 2 is contained in 6 3 times; 2 is contained in 8 4 times.

This process is called *short division.*

2. Divide 369 by 3.
3. Divide 804 by 2.
4. Divide 840 by 4.
5. Divide 555 by 5.
6. Divide 666 by 6.
7. Divide 777 by 7.
8. Divide 969 by 3.
9. Divide 864 by 2.
10. Divide 909 by 9.
11. Divide 6006 by 3.
12. Divide 1400 by 7.
13. Divide 8848 by 4.

14. Divide 875 by 5.

PROCESS.
Divi-
dend.
Divisor, 5)875(175, Quotient.
5
37
35
25
25

5 is contained in 8 hundreds 1 hundred times, with 3 hundreds remaining. 3 hundreds equal 30 tens, which with the 7 tens in the dividend equal 37 tens. 5 is contained in 37 tens 7 tens times, with 2 tens remaining. 2 tens equal 20 units, which with 5 units equal 25 units. 5 is contained in 25 5 times.

PROCESS IN PRACTICE.
Divi-
dend.
Divisor, 5)875
175, Quotient.

In practice we say, 5 is contained in 8 1 time, with 3 remaining.

5 is contained in 37 7 times, with 2 remaining. 5 is contained in 25 5 times.

15. Divide 4557 by 7; also, $47.79 by 8.

7)4557
651, Quotient.

8)$47.79
$5.97, Quotient.
3, Remainder.

16. Divide 216 by 2; by 3; by 4.
17. Divide 1344 by 4; by 6; by 7.
18. Divide 1155 by 3; by 5; by 7.
19. Divide 2016 by 7; by 8; by 9; by 4.
20. Divide 3024 by 6; by 7; by 8; by 9.
21. Divide 18737 by 3; by 4; by 5; by 6.
22. Divide 98095 by 5; by 6; by 7; by 8.
23. Divide 71236 by 8; by 9; by 6; by 7.
24. Divide 86340 by 3; by 5; by 7; by 9.
25. Divide 80436 by 2; by 4; by 6; by 8.
26. Divide 123687 by 6; by 7; by 8; by 9.
27. Divide 904056 by 7; by 8; by 6; by 9.
28. Divide 423648 by 6; by 8; by 7; by 9.
29. Divide $31.50 by 3; by 5; by 7; by 9.

PRACTICAL PROBLEMS.

1. At 6 cents a pound, how many pounds of sugar can be bought for 84 cents?

2. A boy sold newspapers at 5 cents apiece, and in the evening he had 475 cents; how many newspapers did he sell?

3. A grocer gains 3 cents on every pound of coffee; how many pounds must he sell to gain 450 cents?

4. Mr. Howard uses 4 pounds of ice in one hour; how long at the same rate will 488 pounds last him?

5. It takes 8 ounces of tin to make one fruit-can; how many cans can be made from 13824 ounces?

6. A boy averages 7 miles an hour on his bicycle; how long will it take him to go from Philadelphia to Pittsburg, a distance of 353 miles?

7. A gardener puts 9 onion-sets in one row; how many rows will be required for 8964 sets?

8. A man saves $8 a week; how long must he labor to save enough money to pay for his home, which cost him $2048?

9. A train of cars runs 315 miles in 9 hours; what is the average speed per hour?

10. If 8 horses cost $1280, what is the average price of a horse?

11. A farmer raised 1232 bushels of potatoes on 7 acres of land; what was the average yield per acre?

12. A father divided $19206 equally among his 6 children; how much did each child receive?

13. At $5 a ton, how many tons of coal can you buy for $1875?

14. If the average expense in visiting the World's Fair at Chicago was $7 per day, how long could a person visit for $154?

15. A drover paid $2076 for a flock of sheep, at an average price of $4 per head; how many did he buy?

16. If 9 sheets of paper make one book, how many books can be made from 19629 sheets?

LONG DIVISION.

32.—*1.* Divide 2646 by 63.

PROCESS.
63)2646(42, *Ans.*
252
126
126

63 is contained in 264 4 times, with a remainder of 12. Bringing down the next figure of the dividend, we have 126. 63 is contained in 126 2 times, with no remainder. Hence the quotient is 42.

This process is called *long division.*

42
63
126
252
2646

PROOF.—42, the quotient, multiplied by 63, the divisor, equals 2646, the dividend. Hence the work is correct.

Divide—

2. 451 by 11.
3. 372 by 12.
4. 416 by 13.
5. 294 by 14.
6. 330 by 15.
7. 368 by 16.
8. 391 by 17.
9. 450 by 18.
10. 441 by 21.
11. 990 by 22.
12. 1955 by 23.
13. 2132 by 26.
14. 2457 by 27.
15. 3108 by 28.
16. 2624 by 32.
17. 2343 by 33.

18. Divide $122.50 by 35; also, 77700 by 37.

PROCESS.

```
35)$122.50($3.50, Ans.
   105
   ---
    175
    175
    ---
      0
```

PROCESS.

```
37)77700(2100, Ans.
   74
   --
    37
    37
    --
     00
```

Divide—

19. 51660 by 42.
20. 18791 by 43.
21. 72945 by 45.
22. 60466 by 49.
23. 64056 by 51.
24. 28404 by 54.
25. 24192 by 56.
26. 24244 by 58.
27. $290.28 by 59.
28. 46238 by 61.
29. 42777 by 63.
30. 38676 by 66.
31. 82678 by 67.
32. 104832 by 72.
33. 209576 by 68.
34. 195548 by 76.
35. 266112 by 77.
36. $3790.61 by 83.

37. Divide 50061 by 123; also, $7304.58 by 243.

PROCESS.

```
123)50061(407, Ans.
    492
    ---
      861
      861
      ---
```

PROCESS.

```
243)$7304.58($30.06, Ans.
     729
     ---
       1458
       1458
       ----
```

SUGGESTION.—If a remainder with the next figure of the dividend annexed does not contain the divisor, place a cipher in the quotient and annex another figure of the dividend.

Divide—

38. 13464 by 132.
39. 23718 by 134.
40. 34816 by 136.
41. 21025 by 145.
42. 21609 by 147.
43. 40851 by 153.
44. 91008 by 158.
45. $422.82 by 162.
46. 66150 by 175.
47. 49941 by 179.
48. 88504 by 184.
49. 98952 by 186.
50. 36481 by 191.
51. 75077 by 193.
52. 91065 by 195.
53. $752.22 by 199.

54. Divide 420 by 10.

1st Process.
10)420(42, Quotient.
40
20
20

2d Process.
1|0)42|0
42, Quotient.

By comparing these two processes, it is seen that we can divide by 10 by cutting off one figure at the right of the dividend. In the same way we can divide by 100 by cutting off two figures, etc.

Divide—

55. 630 by 10.
56. 7200 by 100.
57. 8000 by 1000.
58. 92000 by 1000.
59. 62100 by 1000.
60. 420000 by 10000.
61. 63 by 10.
62. 720 by 100.

63. Divide 16924 by 1400.

1st Process.
1400)16924(12, *Ans.*
1400
2924
2800
124, Rem.

2d Process.
14)169|24(12, *Ans.*
14
29
28
124, Rem.

Comparing these two processes, it is seen that the work may be very much shortened by omitting the ciphers at the right of the divisor and the same number of figures at the right of the dividend, then dividing and annexing the 24 to the remainder.

Divide—

64. 695 by 30.
65. 953 by 50.
66. 729 by 60.
67. 9675 by 700.
68. 87654 by 800.
69. 76504 by 900.
70. 86547 by 2200.
71. 48514 by 3500.
72. 67584 by 4200.
73. 84432 by 6000.
74. 98743 by 7000.
75. 78654 by 8000.
76. 57423 by 12000.
77. 28645 by 13000.
78. 75321 by 15000.
79. 162800 by 1800.
80. 98400 by 2400.
81. 843000 by 16000.

PRACTICAL PROBLEMS.

1. There are 12 eggs in a dozen; how many dozens in 1728 eggs?

2. There are 20 things in a score; how many scores in 1680 things?

3. There are 16 ounces in a pound; how many pounds in 2560 ounces?

4. There are 4 pecks in a bushel; how many bushels in 6648 pecks?

5. There are 32 quarts in a bushel; how many bushels in 3296 quarts?

6. A farm of 31 acres cost $2604; what was the average price per acre?

7. There are 52 weeks in a year; how many years in 676 weeks?

8. How many barrels can be filled from 5408 gallons of oil if one barrel holds 52 gallons?

9. $6790.77 were paid to 63 soldiers; what was the average sum paid to each soldier?

10. How many hogsheads of 63 gallons each in a reservoir which contains 89208 gallons?

11. How many cows at $32 each can be exchanged for 96 horses at $120 each?

12. A bought a farm of 92 acres for $6900; what was the average price per acre?

13. A firm paid to 43 employees $1935 per month; what were the average monthly wages?

14. There are 231 cubic inches in a gallon of water; how many gallons in 14322 cubic inches of water?

15. There are 144 square inches in one square foot; how many square feet in 54432 square inches?

16. How many barrels can be filled from 9408 pounds of flour if one barrel contains 196 pounds?

17. A bushel of corn weighs 56 pounds; how many bushels in 11368 pounds?

18. If a box holds 200 oranges, how many boxes will 26200 oranges fill?

19. There are 160 perches in an acre; how many acres in 2560 perches?

20. There are 80 chains in a mile; how many miles in 4240 chains?

21. There are 2000 pounds in a ton; how many tons in 12000 pounds?

22. If a vessel sails at an average rate of 53 miles a day, in what time will it sail 3710 miles?

23. How many hours in 12420 minutes if there are 60 minutes in one hour?

24. There are 36 inches in a yard; how many yards in 11016 inches?

25. If 65 books can be packed in a box, how many boxes will it take to hold 13195 books?

26. How many companies, averaging 98 men to a company, can be formed from an army of 10976 men?

27. The combined wealth of the 62 wealthiest men in the city of A. is $765,390; what is the average wealth of each?

28. A Western farmer raised 5964 bushels of wheat on 213 acres; what was the average yield per acre?

DEFINITIONS.

33. Division is the process of finding how many times one number is contained in another.

The **Dividend** is the number to be divided.

The **Divisor** is the number by which we divide.

The **Quotient** is the number of times the dividend contains the divisor.

The **Remainder** is a part of the dividend which is sometimes left after dividing.

34. The **Sign of Division** is ÷, and is read *divided by.* When placed between two numbers it indicates that the number before it is to be divided by the number after it. Thus, 18 ÷ 3 = 6, is read 18 *divided by* 3 *equals* 6.

35. There are two methods of division, called *Short Division* and *Long Division.*

In *Short Division* the remainders and partial products are not written.

In *Long Division* the remainders and partial products are written.

PRACTICAL PROBLEMS

On the Four Fundamental Rules.

1. The minuend is 8675 and the subtrahend 2080; what is the difference?

2. The subtrahend is 4652 and the difference is 2448; what is the minuend?

3. The minuend is 9247 and the difference is 6007; what is the subtrahend?

4. The multiplicand is 2037 and the multiplier is 21; what is the product?

5. The product is 3773 and the multiplier is 77; what is the multiplicand?

6. The product is 126498 and the multiplicand is 2181; what is the multiplier?

7. The dividend is 317646 and the divisor is 126; what is the quotient?

8. The dividend is 173911 and the quotient is 2851; what is the divisor?

9. The quotient is 2521 and the divisor is 126; what is the dividend?

10. The divisor is 82, the quotient is 66, and the remainder is 50; what is the dividend?

11. The divisor is 120, the quotient is 72, and the remainder is 14; what is the dividend?

12. My barn cost $1312, my house cost four times as much as the barn, and my farm cost three times as much as both; required the cost of all.

13. A farmer took to a store 16 pounds of butter at 32 cents a pound, and 48 dozens of eggs at 26 cents a dozen, and received in exchange muslin at 16 cents a yard; how many yards did he receive?

14. A drover sold 25 horses for $3300 and gained $375 on the sale; what was the average cost of each horse?

15. A farmer bought 20 cows at an average price of $32 a head and sold 8 of them at cost; how much must he receive a head for the remainder to gain $132 on the transaction?

16. A bought a farm of 216 acres at $85 an acre. He agrees to pay $8000 cash and the remainder in five equal annual payments; what sum must he pay annually?

17. If 8 apples cost 48 cents, what will 7 apples cost?

PROCESS.
8 apples = 48 cents,
1 apple = 6 cents,
7 apples = 42 cents.

If 8 apples cost 48 cents, 1 apple will cost one-eighth of 48 cents, or 6 cents; and 7 apples will cost 7 times 6 cents, or 42 cents.

18. If 9 sheep cost $72, what will 7 sheep cost at the same rate?

19. If 16 cows cost $352, what will 35 cows cost at the same rate?

20. If 30 barrels of flour weigh 5880 pounds, what will 42 barrels weigh?

21. B paid $115.50 for 22 barrels of apples; what will 73 barrels cost at the same rate?

22. What will 125 bushels of potatoes cost at the rate of 23 bushels for $34.50?

23. If 20 gallons contain 4620 cubic inches, how many cubic inches in 116 gallons?

24. If 15 barrels of oil cost $225, what will 210 barrels cost at the same rate?

25. C paid $3510 for 15 acres of land; what would a farm of 116 acres cost at the same rate?

26. A telephone company receives a yearly income of $14,532 from 346 telephones; what is the average income from each telephone?

ORIGINAL PROBLEMS.

1. If $350 were divided equally among the members of this class, how many dollars would each receive, and what amount would remain?

2. Give the price of eggs per dozen and the entire cost, to find the number of dozens.

3. Give the price of sugar per pound and the entire cost, to find the number of pounds.

4. Give the cost of a man's farm and the number of acres, to find the price per acre.

5. Give the area of the school-room and the length, to find the width.

6. Give the number of trees in an orchard and the number of rows, to find the number of trees in a row.

7. Find the sum of the ages of all the members of your class, and the average age of the pupils.

BILLS.

1.

Boston, Jan. 23, 1894.

Mr. William Noble,

Bought of John Boyd.

38 yards of Cloth,	@	$1.15	$43	70
60 yards of Oil-cloth,	"	.45	27	00
18 Mats,	"	4.25	76	50
12 Rugs,	"	3.00	36	00
6 Carpet-sweepers,	"	3.25	19	50
			$202	70

Received Payment,

John Boyd.

A bill is made out by writing the names of the purchaser and seller under the date, with an orderly arrangement of the number or amount of each article, with its price, and finding the sum of their several costs.

2.

New York, July 9, 1894.

Mr. W. C. Frew,

Bought of Henry Bowman.

16 pairs of	Boots,	@	$4.50		
28 "	Gaiters,	"	3.80		
54 "	Slippers,	"	1.60		
90 "	Rubbers,	"	.75		
64 "	Shoes,	"	2.50		
				$	

3.

Philadelphia, Feb. 19, 1894.

Dr. H. F. Bitner,

Bought of Bullock & Crenshaw.

8 lb. Ammonia,	@	$ .11		
2 oz. Antimony,	"	.20		
2 doz. Bottles,	"	3.15		
10 " Test-tubes,	"	.70		
4 " Evap. Dishes,	"	1.44		
12 oz. Chloride of Lime,	"	.20		

Received Payment,

Bullock & Crenshaw.

4.

Chicago, Nov. 4, 1894.

Mr. John M. Groff,

To Martin & Co., Dr.

1894.						
Jan.	4	To 145 bu. Wheat,	@	$1.10	$	
"	16	" 300 " Corn,	"	.70		
Mar.	20	" 220 " Rye,	"	1.12		
"	30	" 500 " Oats,	"	.40		
May	10	" 200 " Corn,	"	.75		
"	24	" 150 " Rye,	"	1.15		
1894.		*—Cr.—*				
Jan.	6	By Cash,			$150	50
Mar.	22	" Draft,			450	00
May	12	" Cash,			300	00

How much is due Martin & Co.?

Make out in proper form and receipt the following bills:

5. Mr. J. W. Cooper, bought of A. M. Anderson, 25 yd. of Muslin, @ 10 cents a yd.; 40 yd. of Calico, @ 8 cents a yd.; 16 yd. of Ribbon, @ 25 cents a yd.; 36 yd. of Sheeting, @ 12 cents a yd.; and 8 pairs of Gloves, @ $1.25 a pair. How much is due?

6. William King, bought of Henry Jones, 10 yards of Broadcloth, at $5.75 a yard; 4 yards of Silk, at $1.87 a yard; 8 yards of Flannel, at $.85 a yard; and 42 yards of Muslin, at $.13 a yard. How much is due?

7. James Long, bought of Henry Young, 125 pounds of Coffee, at $.25 a pound; 250 pounds of Sugar, at $.06 a pound; 75 pounds of Rice, at $.09 a pound; and 12 pounds of Tea, at $1.10 a pound. How much is due?

8. John Martin, bought of Samuel P. Hambleton, 25 dozen Tumblers, at $1.85 per dozen; 45 dozen Plates, at $2.25 per dozen; 12 Tea-sets, at $1.87 a set; and 8 sets of Dessert-spoons, at $4.75 a set. How much is due?

NOTE.—The following abbreviations are used in the foregoing bills: Dr. = Debtor (the one who owes); Cr. = Creditor (the one to whom something is owed); @ = at; lb. = pounds; oz. = ounces; doz. = dozens; bu. = bushels; yd. = yards.

DEFINITIONS.

36. A **Bill** is a written statement of goods sold, with the amount and price of each article, and the entire cost.

37. The person to whom a debt is due is called the **Creditor**, and the person owing the debt is called the **Debtor**.

38. A bill is **Receipted** when the person to whom payment is made writes at the bottom of the bill *Received Payment* and signs his name.

39. A bill showing a debit and credit account between the parties is called an **Account Current**.

MAKING CHANGE.

1. If you buy 9 pounds of sugar at 6 cents a pound, and you give the grocer a dollar-bill in payment, how will he count the change due you?

Answer.—Giving me the sugar, he would count that as 54 cents, and then hand me in succession 1 cent, 10 cents, 10 cents, and 25 cents, counting **54, 55, 65, 75, $1.** This is the most convenient way to make change.

2. How will the change be counted in taking 35 cents out of $1?

3. How will the change be counted in taking $1.63 out of $2?

4. How will the change be counted in taking $4.51 out of $5?

5. How will the change be counted if you buy 4 pounds of coffee at 31 cents a pound, and give in payment $5?

GENERAL REVIEW.

1. Numeration and Notation.

1. Write eighty-nine in Roman numerals.

2. Write 405 million, 816 thousand, 416 units in figures.

3. Write one thousand four hundred and fifteen dollars and ten cents.

4. Read XXIX; 408,008,102; XCIX; 600,006.

5. Read $106.08; $4,001.85; $4,004,080.05; $9,000.09.

6. Write seventy-eight in Roman numerals.

7. Write 106 million, 404 thousand, 909 units in figures.

8. Write forty-two thousand three hundred and ten dollars and sixty-five cents.

9. Read XLIX; 40,040,405; XXXIV; LXVI.

10. Read $2018.43; $942,429,670.02; $8,008,008.08; $5,408,616.04; $400,500.05.

11. Write forty-one in Roman numerals.

12. Write 40 million, 40 thousand, and 40 units in figures.

13. Write fifty-five thousand, four hundred and twenty dollars and six cents.

14. Read LXXXVII; 104,860,918; LXXVIII; 300,003,300; XLIV.

15. Read $4,008,621.62; $82,082,820.71; $600,215,408.71; $40,300.02.

16. Write twenty-one, seventy-six, and thirty-two in Roman numerals.

17. Fill the first period with 4's, the second with 5's, and the third with 6's, and read the number.

18. Fill the first four places with 1's, the next four places with 2's, and the ninth place with 3, and read the number.

19. Write the numbers from 20 to 40 in Roman numerals.

20. Write the largest number you can read.

2. United States Money.

Arrange each line in column and add—

1. $13.86, $400, $20.02, $78.18, $10.01, $700.15.
2. $42.70, $11.04, $500, $78.04, $9.09, $7000.
3. $98.06, $.90, $900, $816.04, $12.03, $900.01.
4. $46.20, $.42, $80, $16.25, $401.28, $34.35.

5. Subtract $19.25 from $120.42.
6. Subtract $41.32 from $100.
7. Subtract $304.70 from $1000.
8. Subtract $42.41 from $85.
9. Multiply $3162.75 by 123.
10. Multiply $4232.81 by 105.

11. Multiply $204.62 by 24 and add $10,345.16 to the result.

12. Multiply $610.08 by 51 and subtract $516.75 from the result.

13. Divide $2115.14 by 34.

3. Fundamental Processes.

EXAMPLES.

1. Add by lines and find the sum of the results—

6841 + 5000 + 1402 + 7602 + 8010 =
4306 + 6371 + 8632 + 1045 + 7608 =
1234 + 5678 + 9012 + 3456 + 7990 =
5678 + 9012 + 3456 + 7890 + 1234 =
6007 + 7061 + 9045 + 1879 + 6325 =
6321 + 7984 + 4321 + 7654 + 2972 =

2. Find the difference between 94879 and each of the fol-
owing numbers:

100000 444444 223344 909090 800000
871213 600024 800400 980731 421632

3. Find the difference between 84629 and each of the fol-
owing numbers:

128000 416302 910020 562132 700024
802040 520041 980731 716215 603152

4. Multiply 123456789 by 9; by 18; by 27; by 36; by 45.

5. Multiply 987654321 by 9; by 18; by 27; by 36; by 45.

6. Multiply each number in the columns below by 26; by
2; by 104:

413 435 302 632 2145 5432
517 124 612 456 2046 6009
621 902 321 834 2150 4032
132 806 142 234 3216 7080

7. Divide each of the following numbers by 32; by 96;
y 192:

5376 13056 40704 120576 9984
6912 16128 45312 194688 38784
8064 28032 48000 310656 88704
8832 36480 77952 376320 403200

PRACTICAL PROBLEMS.

1. The number of days in each month of the year is—

January, 31.
February, 28.
March, 31.
April, 30.
May, 31.
June, 30.
July, 31.
August, 31.
September, 30.
October, 31.
November, 30.
December, 31.

How many days less in the first 6 than in the last 6 months?

2. How many strokes does the hammer of a clock make in a day, if it strikes only the hours? How many in a week? How many in the month of May?

3. A child's pulse beats 78 times in a minute; how often does it beat in an hour (60 minutes)? In a day (24 hours)? In the month of June?

4. Robert has $4250, Ethel has 3 times as much lacking $1225; how much have they both?

5. Mr. White earns $42 a week, and Mr. Lyte earns $54 in the same time; how much will Mr. Lyte earn while Mr. White earns $1722?

6. The diameter of the earth is nearly 8000 miles; how long would it take a boy to travel that distance on a bicycle at the rate of 32 miles a day?

7. The circumference of the earth is about 25000 miles; how long would it take a person to walk that distance at the rate of 25 miles a day?

8. The national debt of the United States at the close of the Civil War was $2,773,236,173.69; in 1890 it was $934,230,496.60; how much had the debt decreased?

9. The wheel of a bicycle is 12 feet in circumference; how many revolutions will it make in going 100 miles (5280 feet in a mile)?

10. If a boy earns $18 a month, and a man $32 a month, how much will 8 boys and 10 men earn in a month?

11. Two men start to walk in opposite directions, the first at the rate of 30 miles a day, and the second at the rate of 42 miles a day; how far apart will they be in 120 days? How far apart will they be if they travel in the same direction?

12. I bought a quantity of grain for $9406, paid $52 freight and $105 storage, and sold it at a gain of $412; what did I receive for it?

13. If the President of the United States spends $84 daily, how much can he save in a year of 365 days out of a salary of $50,000?

14. What will 112 acres of land cost, if 65 acres cost $8125?

15. If 16 books cost $4.32, what will 340 books cost at the same rate?

16. If it requires 1134 bricks to build 54 cubic feet of wall, how many bricks will be required to build 2415 cubic feet?

17. The value of 8 horses and 12 cows is $1960; if the value of each horse is $122, what is the value of each cow?

18. The value of 12 horses, 15 mules, and 18 cows is $5013; if the value of each mule is $115, and the value of each cow is $36, what is the value of a horse?

19. A man bought a farm for $5760, and sold 75 acres at $42 an acre, and the remainder for $3000; how much did he make by the transaction?

20. I sold my farm of 115 acres at $205 an acre, and received in payment a note worth $20,985; how much remains unpaid?

21. A sold his farm of 140 acres at $186 an acre, and bought with the proceeds another farm at $210 an acre; how many acres in the latter farm?

22. A canal-boat goes 30 miles in 10 hours, and a railroad train 40 miles an hour; how far will the railroad train go while the canal-boat goes 96 miles?

23. A farmer exchanged 40 bushels of wheat at 60 cents a bushel for muslin at 12 cents a yard; how many yards did he get?

24. A and B have $12, but A has $4 more than B; how much has each?

25. C and D have $586, but C has $40 less than D; how much has each?

26. Mount Everest in Asia is 29002 feet high; how many miles high is it, there being 5280 feet in a mile?

27. There are 18 rows of trees in an orchard and 18 trees in a row; how many trees are there? If there were twice as many rows and three times as many trees in a row, how many trees would there be?

28. A farmer owns 8 farms containing respectively 90, 112, 116, 142, 174, 202, 218, and 220 acres; how much more land would he have if each farm contained 200 acres?

29. A boy's account with a savings bank is as follows: January 1st, paid in $16; February 4th, paid in $21; March 5th, drew out $10; April 1st, paid in $41; April 16th, paid in $17; May 3d, drew out $50; June 10th, paid in $23; July 6th, paid in $19; August 1st, paid in $31; September 20th, drew out $15; October 12th, paid in $35; November 20th, paid in $27; December 24th, drew out $30; how much was due him?

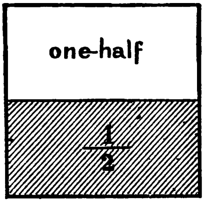
30. The distance from New York to Philadelphia is 90 miles; from Philadelphia to Chicago, 890 miles; from Chicago to San Francisco, 2420 miles; how many feet from New York to San Francisco by this route (5280 feet in a mile)?

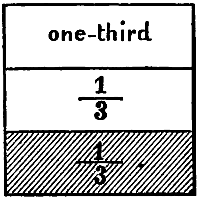
31. A mechanic sold a farmer a wagon for $48.25, three plows at $5.50 each, and 8 rakes at $10.50 each, and bought of the farmer 40 bushels of potatoes at 80 cents a bushel and 100 bushels of wheat at 55 cents a bushel; which owes the other, and how much?

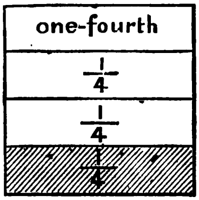
32. A farmer sold a merchant 3 cows at $40.50 each and 10 sheep at $6.50 each, and took in payment 40 yards of cloth at $2.25 a yard, 60 yards of carpet at $1.25 a yard, and 40 yards of muslin at 9 cents a yard; which owes the other, and how much?

SECTION III.

COMMON FRACTIONS.







40.—*1.* If a square inch is divided into *two* equal parts, what is one of these parts called?

2. How many *halves* in a square inch?

3. If a square inch is divided into *three* equal parts, what is one of these parts called? What are two parts called?

4. How many *thirds* in a square inch?

5. If a square inch is divided into *four* equal parts, what is one of these parts called? What are two parts called? Three parts? Four parts?

6. How many *fourths* in a square inch? How many fourths in anything?

7. If an apple is divided into *five* equal parts, what is one of these parts called?

8. How many *fifths* in an apple?

9. If an apple is cut into *six* equal parts, what part of the apple is one of these parts? What part of the apple are two parts? Three parts? Four parts? Five parts? Six parts?

10. Which is the larger, one-half or one-third? One-third or one-fourth?

11. What is meant by one-half? Ans. *One-half is one of the two equal parts of anything.*

12. What is meant by one-third? One-fourth? One-fifth? One-sixth? Two-thirds? Three-fourths? Three-fifths?

41. These equal parts, one-half, one-third, three-fifths, etc., are called *Fractions.*

A fraction is usually expressed by writing one number above another with a short line between them. Thus,

One-half is written $\frac{1}{2}$.
One-third is written $\frac{1}{3}$.
Three-fifths is written $\frac{3}{5}$, etc.

Write the following fractions:

1 sixth;	1 seventh;	1 eighth;	1 tenth;
2 sixths;	3 sevenths;	2 eighths;	4 tenths;
3 sixths;	5 sevenths;	5 eighths;	7 tenths;
5 sixths;	6 sevenths;	7 eighths;	9 tenths.

Read the following fractions:

$\frac{1}{5}$	$\frac{6}{7}$	$\frac{2}{3}$	$\frac{2}{5}$	$\frac{9}{6}$	$\frac{12}{30}$
$\frac{3}{5}$	$\frac{5}{9}$	$\frac{6}{11}$	$\frac{6}{8}$	$\frac{9}{11}$	$\frac{16}{31}$
$\frac{4}{5}$	$\frac{11}{12}$	$\frac{7}{15}$	$\frac{5}{12}$	$\frac{9}{9}$	$\frac{18}{24}$
$\frac{7}{8}$	$\frac{9}{12}$	$\frac{5}{3}$	$\frac{6}{16}$	$\frac{15}{16}$	$\frac{15}{36}$

DEFINITIONS.

42. A **Fraction** is one or more of the equal parts of a unit; as, $\frac{2}{3}$.

The number below the line is called the **Denominator**, and shows into how many parts the unit is divided.

The number above the line is called the **Numerator**, and shows how many of the equal parts are taken.

The numerator and the denominator are called the **Terms** of a fraction.

43. When the numerator is less than the denominator, as $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{8}$, etc., the fraction is called a **Proper Fraction.**

When the numerator is equal to or greater than the denominator, as $\frac{4}{4}$, $\frac{6}{5}$, $\frac{8}{7}$, etc., the fraction is called an **Improper Fraction.**

44. A **Mixed Number** is the sum of a whole number and a fraction; as, $6 + \frac{2}{3}$, or $6\frac{2}{3}$.

45. A fraction is another form of division, in which the numerator is the dividend and the denominator the divisor. Thus, $\frac{15}{5} = 15 \div 5 = 3$.

REDUCTION OF FRACTIONS.

CASE I.

46. To reduce an improper fraction to a whole or mixed number.

ORAL EXERCISES.

1. How many ones in $\frac{3}{3}$? $\frac{6}{3}$? $\frac{9}{3}$?
2. How many ones in $\frac{12}{4}$? $\frac{16}{4}$? $\frac{20}{4}$?
3. How many ones in $\frac{12}{6}$? $\frac{18}{6}$? $\frac{24}{6}$?
4. How many ones in $\frac{16}{8}$? $\frac{24}{8}$? $\frac{32}{8}$?
5. How many ones in $\frac{63}{9}$? $\frac{72}{9}$? $\frac{81}{9}$?
6. How many ones in $\frac{14}{3}$?

SUGGESTION.—In one there are 3 thirds, and in 14 thirds there are as many ones as 3 thirds are contained times in 14 thirds, which is $4\frac{2}{3}$ times, *Ans.*

7. How many ones in $\frac{17}{3}$? $\frac{19}{4}$? $\frac{22}{5}$?
8. How many ones in $\frac{36}{7}$? $\frac{40}{9}$? $\frac{49}{8}$?
9. How many ones in $\frac{70}{9}$? $\frac{81}{8}$? $\frac{65}{6}$?
10. How many ones in $\frac{26}{4}$? $\frac{64}{9}$? $\frac{75}{8}$?
11. How many ones in $\frac{32}{5}$? $\frac{49}{8}$? $\frac{100}{9}$?
12. How many ones in $\frac{65}{4}$? $\frac{92}{7}$? $\frac{112}{8}$?

WRITTEN EXERCISES.

13. Reduce $\frac{417}{23}$ to a mixed number.

Process.—$\frac{417}{23} = 417 + 23 = 18\frac{3}{23}$, *Ans.*

Reduce to whole or mixed numbers:

14. $\frac{211}{8}$.
15. $\frac{312}{11}$.
16. $\frac{305}{12}$.
17. $\frac{317}{10}$.
18. $\frac{337}{15}$.
19. $\frac{389}{16}$.
20. $\frac{348}{17}$.
21. $\frac{701}{13}$.
22. $\frac{521}{23}$.
23. $\frac{929}{22}$.
24. $\frac{1873}{33}$.
25. $\frac{262}{37}$.
26. $\frac{1002}{39}$.
27. $\frac{1807}{40}$.
28. $\frac{1500}{41}$.
29. $\frac{1201}{42}$.

CASE II.

47. To reduce a mixed number to an improper fraction.

ORAL EXERCISES.

1. How many thirds in 1? In 2? In 3?
2. How many fourths in 1? In 5? In 6?
3. How many fifths in 1? In 6? In 9?
4. How many sixths in 1? In 7? In 10?
5. How many thirds in 1? In $7\frac{2}{3}$?

Suggestion.—$7\frac{2}{3} = 7 + \frac{2}{3}$. In 7 there are $\frac{21}{3}$, and in $7\frac{2}{3}$ there are $\frac{21}{3} + \frac{2}{3} = \frac{23}{3}$, *Ans.*

6. How many thirds in $4\frac{2}{3}$? In $6\frac{2}{3}$? In $5\frac{1}{3}$?
7. How many fourths in $2\frac{3}{4}$? In $5\frac{1}{4}$? In $6\frac{3}{4}$?
8. How many fifths in $3\frac{3}{5}$? In $4\frac{4}{5}$? In $9\frac{2}{5}$?
9. How many ninths in $6\frac{5}{9}$? In $7\frac{7}{9}$? In $8\frac{8}{9}$?
10. How many tenths in $7\frac{3}{10}$? In $11\frac{1}{10}$? In $9\frac{8}{10}$?
11. How many elevenths in $2\frac{8}{11}$? In $3\frac{5}{11}$? In $4\frac{6}{11}$?
12. How many twelfths in $2\frac{1}{12}$? In $3\frac{5}{12}$? In $5\frac{7}{12}$?
13. How many twentieths in $2\frac{1}{20}$? In $4\frac{3}{20}$? In $5\frac{1}{20}$?
14. How many thirtieths in $3\frac{1}{30}$? In $2\frac{7}{30}$? In $4\frac{11}{30}$?
15. How many tenths in $12\frac{1}{10}$? In $15\frac{3}{10}$? In $20\frac{1}{10}$?
16. How many fiftieths in $2\frac{1}{50}$? In $3\frac{3}{50}$? In $4\frac{9}{50}$?

WRITTEN EXERCISES.

17. Reduce 24 to fifths; $24\frac{2}{5}$ to fifths.

PROCESS.

$$\begin{array}{r} 24 \\ 5 \\ \hline \frac{120}{5}, \textit{ Ans.} \end{array}$$

1ST.—In one there are 5 fifths, and in 24 there are 24 times 5 fifths, which are 120 fifths, or $\frac{120}{5}$, *Ans.*

2D.—In 24 there are 120 fifths; 120 fifths + 2 fifths = 122 fifths, or $\frac{122}{5}$, *Ans.*

PROCESS.

$$\begin{array}{r} 24\frac{2}{5} \\ 5 \\ \hline 120 \\ 2 \\ \hline \frac{122}{5}, \textit{ Ans.} \end{array}$$

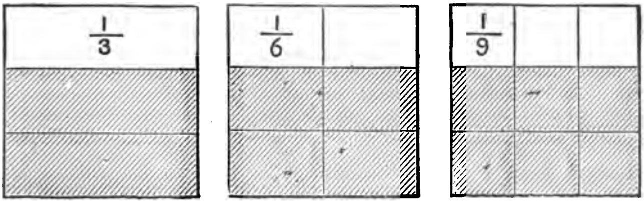
Reduce to improper fractions—

18. $10\frac{3}{4}$.
19. $12\frac{7}{8}$.
20. $14\frac{6}{7}$.
21. $15\frac{7}{9}$.
22. $20\frac{2}{3}$.
23. $30\frac{5}{8}$.
24. $43\frac{5}{6}$.
25. $67\frac{3}{4}$.
26. $63\frac{8}{9}$.
27. $75\frac{7}{10}$.
28. $52\frac{6}{13}$.
29. $61\frac{7}{15}$.
30. $62\frac{8}{21}$.
31. $85\frac{7}{25}$.
32. $100\frac{7}{11}$.
33. $56\frac{19}{27}$.
34. $106\frac{6}{17}$.
35. $102\frac{9}{14}$.
36. $516\frac{4}{5}$.
37. $84\frac{4}{19}$.
38. $134\frac{3}{5}$.
39. $125\frac{2}{3}$.
40. $160\frac{6}{7}$.
41. $105\frac{5}{16}$.
42. $111\frac{1}{9}$.
43. $123\frac{7}{8}$.
44. $234\frac{4}{5}$.

CASE III.

48. **To reduce fractions to higher or lower terms.**

ORAL EXERCISES.



$$\frac{2}{3} = \frac{4}{6} = \frac{6}{9}$$

1. How many thirds in a square inch? How many sixths? How many ninths?

From the foregoing illustration it is seen that $\frac{2}{3} = \frac{4}{6} = \frac{6}{9}$.

2. How many sixths in $\frac{2}{3}$ of a square inch? (See Fig. 2 p. 101.)

3. How many ninths in $\frac{2}{3}$ of a square inch? (See Fig. 3, p. 101.)

4. How may we get $\frac{4}{6}$ from $\frac{2}{3}$? And $\frac{2}{3}$ from $\frac{4}{6}$?

5. How may we get $\frac{6}{9}$ from $\frac{2}{3}$? And $\frac{2}{3}$ from $\frac{6}{9}$?

6. What, then, may be done to the terms of a fraction without changing its value?

49. Principle.—*Multiplying or dividing both terms of a fraction by the same number does not change the value of the fraction.*

7. How many halves in $\frac{6}{12}$? $\frac{8}{16}$? $\frac{10}{20}$?

8. How many thirds in $\frac{3}{9}$? $\frac{8}{12}$? $\frac{16}{24}$?

9. How many fifths in $\frac{5}{25}$? $\frac{12}{30}$? $\frac{28}{35}$?

10. How many sixths in $\frac{2}{12}$? $\frac{15}{18}$? $\frac{12}{24}$?

11. Reduce $\frac{1}{2}$ and $\frac{1}{3}$ to sixths.

12. Reduce $\frac{1}{3}$ and $\frac{1}{4}$ to twelfths.

13. Reduce $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{5}{6}$ to twelfths.

14. Reduce $\frac{1}{2}$ and $\frac{2}{5}$ to tenths.

WRITTEN EXERCISES.

15. Reduce $\frac{24}{30}$ to its lowest terms.

PROCESS.

$2 \mid \frac{24}{30} = \frac{12}{15}$

$3 \mid \frac{12}{15} = \frac{4}{5}$, *Ans.*

Since dividing both terms of a fraction by the same number does not change its value, we divide both terms of $\frac{24}{30}$ by 2, and obtain $\frac{12}{15}$; then dividing both terms of $\frac{12}{15}$ by 3, we have $\frac{4}{5}$.

Hence, to reduce a fraction to its lowest terms, *Divide both terms of the fraction by the same number, and continue to divide until the terms have no common divisor.*

Reduce to their lowest terms—

16. $\frac{6}{9}$, $\frac{8}{12}$.

17. $\frac{10}{12}$, $\frac{15}{18}$, $\frac{35}{42}$.

18. $\frac{12}{36}$, $\frac{14}{42}$, $\frac{15}{45}$.

19. $\frac{16}{24}$, $\frac{24}{36}$, $\frac{32}{48}$.

20. $\frac{18}{24}$, $\frac{30}{40}$, $\frac{21}{28}$.

21. $\frac{40}{48}$, $\frac{60}{72}$, $\frac{56}{64}$.

22. $\frac{70}{80}$, $\frac{66}{72}$, $\frac{45}{50}$.

23. $\frac{100}{120}$, $\frac{160}{240}$, $\frac{121}{132}$.

24. $\frac{96}{104}$, $\frac{144}{156}$, $\frac{32}{144}$.

25. $\frac{48}{176}$, $\frac{90}{330}$, $\frac{108}{396}$.

26. Reduce $\frac{5}{12}$ to 120ths.

PROCESS.

$$\frac{5 \times 10}{12 \times 10} = \frac{50}{120}$$

Since the fraction is to be reduced to 120ths, we must multiply both terms by some number that will make the denominator 120. This number is found by dividing 120 by 12, which gives 10. Multiplying both terms of $\frac{5}{12}$ by 10, we have $\frac{50}{120}$.

Hence, to reduce a fraction to higher terms, *Multiply both terms by a number that will give the required denominator.*

Reduce—

27. $\frac{3}{4}$ to 32ds.
28. $\frac{5}{6}$ to 60ths.
29. $\frac{7}{8}$ to 40ths. To 56ths.
30. $\frac{9}{10}$ to 50ths. To 80ths.
31. $\frac{2}{3}$ to 36ths. To 48ths.
32. $\frac{3}{5}$ to 20ths. To 45ths.
33. $\frac{3}{7}$ to 21sts. To 63ds.
34. $\frac{5}{12}$ to 72ds. To 96ths.
35. $\frac{5}{9}$ to 63ds. To 108ths.

36. $\frac{13}{22}$ to 66ths. To 88ths.
37. $\frac{11}{15}$ to 60ths. To 90ths.
38. $\frac{5}{21}$ to 84ths. To 105ths.
39. $\frac{8}{9}$ to 90ths. To 189ths.
40. $\frac{8}{13}$ to 156ths. To 169ths.
41. $\frac{8}{11}$ to 77ths. To 121sts.
42. $\frac{5}{18}$ to 90ths. To 108ths.
43. $\frac{4}{5}$ to 500ths. To 600ths.
44. $\frac{7}{8}$ to 96ths. To 120ths.

45. Reduce $\frac{2}{3}$ and $\frac{3}{4}$ to 12ths.
46. Reduce $\frac{3}{4}$ and $\frac{7}{8}$ to 8ths.
47. Reduce $\frac{5}{6}$ and $\frac{3}{4}$ to 24ths.
48. Reduce $\frac{2}{5}$ and $\frac{5}{6}$ to 30ths.

When fractions have the same number for a denominator they have a *Common Denominator.*

Reduce to equivalent fractions with a common denominator—

49. $\frac{2}{3}$, $\frac{5}{6}$, and $\frac{5}{9}$.
50. $\frac{3}{5}$, $\frac{7}{10}$, and $\frac{8}{15}$.
51. $\frac{1}{4}$, $\frac{7}{8}$, and $\frac{5}{12}$.
52. $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{7}{8}$.
53. $\frac{3}{1}$, $\frac{4}{7}$, and $\frac{9}{14}$.
54. $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{7}{8}$.
55. $\frac{5}{8}$, $\frac{3}{16}$, and $\frac{15}{24}$.

56. $\frac{2}{3}$, $\frac{3}{5}$, and $\frac{13}{30}$.
57. $\frac{4}{9}$, $\frac{5}{12}$, and $\frac{7}{18}$.
58. $\frac{3}{8}$, $\frac{2}{5}$, and $\frac{11}{20}$.
59. $\frac{5}{16}$, $\frac{1}{2}$, and $\frac{3}{64}$.
60. $\frac{7}{32}$, $\frac{3}{48}$, and $\frac{11}{96}$.
61. $\frac{13}{24}$, $\frac{8}{9}$, and $\frac{5}{8}$.
62. $\frac{3}{13}$, $\frac{12}{26}$, and $\frac{17}{52}$.

ADDITION OF FRACTIONS.

ORAL EXERCISES.

50.—*1.* How many thirds are $\frac{1}{3} + \frac{1}{3} + \frac{1}{3}$?

2. How many fifths are $\frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5}$?

3. How many sixths are $\frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6}$?

4. What is the sum of $\frac{2}{5}$ and $\frac{3}{5}$?

5. What is the sum of $\frac{3}{7}$ and $\frac{2}{7}$?

6. What is the sum of $\frac{3}{8}$ and $\frac{2}{8}$?

What is the sum of—

7. $\frac{3}{5}$ and $\frac{4}{5}$?
8. $\frac{2}{9}$ and $\frac{3}{9}$?
9. $\frac{7}{12}$, $\frac{5}{12}$, and $\frac{11}{12}$?
10. $\frac{5}{14}$, $\frac{6}{14}$, and $\frac{7}{14}$?
11. $\frac{3}{11}$, $\frac{4}{11}$, and $\frac{5}{11}$?
12. $\frac{6}{18}$, $\frac{2}{18}$, and $\frac{4}{18}$?
13. $\frac{7}{15}$, $\frac{3}{15}$, and $\frac{4}{15}$?
14. $\frac{2}{17}$, $\frac{3}{17}$, and $\frac{7}{17}$?

15. What is the sum of $\frac{1}{2}$ and $\frac{1}{3}$?

We cannot add these fractions as they are; therefore we must reduc them to a common denominator.

$$\frac{1}{2} = \frac{3}{6}, \text{ and } \frac{1}{3} = \frac{2}{6};\ \frac{3}{6} + \frac{2}{6} = \frac{5}{6}, \textit{ Ans.}$$

To add fractions they must have a common denominator.

What is the sum—

16. Of $\frac{1}{2}$ and $\frac{1}{4}$?
17. Of $\frac{1}{3}$ and $\frac{1}{4}$?
18. Of $\frac{1}{4}$ and $\frac{1}{5}$?
19. Of $\frac{1}{6}$ and $\frac{1}{7}$?
20. Of $\frac{1}{4}$ and $\frac{1}{7}$?
21. Of $\frac{1}{3}$ and $\frac{1}{9}$?
22. Of $\frac{1}{5}$ and $\frac{1}{7}$?
23. Of $\frac{1}{6}$ and $\frac{1}{5}$?
24. Of $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$?

WRITTEN EXERCISES.

25. What is the sum of $\frac{5}{12}$ and $\frac{7}{15}$?

PROCESS.—$\frac{5}{12} + \frac{7}{15} = \frac{25}{60} + \frac{28}{60} = \frac{43}{60}$, *Ans.*

Reducing the fractions to a common denominator, we have $\frac{5}{12} = \frac{25}{60}$ $\frac{7}{15} = \frac{28}{60}$; the sum of 25 sixtieths and 28 sixtieths is 43 sixtieths, or $\frac{43}{60}$.

Add the following fractions:

26. $\frac{2}{3}$ and $\frac{5}{6}$.
27. $\frac{7}{12}$ and $\frac{13}{24}$.
28. $\frac{5}{6}$ and $\frac{3}{8}$.
29. $\frac{6}{7}$ and $\frac{7}{8}$.
30. $\frac{4}{11}$ and $\frac{5}{22}$.
31. $\frac{8}{15}$ and $\frac{11}{30}$.
32. $\frac{4}{7}$ and $\frac{9}{49}$.
33. $\frac{5}{16}$ and $\frac{11}{56}$.
34. $\frac{11}{18}$ and $\frac{5}{63}$.
35. $\frac{5}{24}$ and $\frac{8}{60}$.
36. $\frac{2}{3}$, $\frac{5}{6}$, and $\frac{7}{8}$.
37. $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{3}{8}$.
38. $\frac{3}{4}$, $\frac{5}{7}$, and $\frac{9}{14}$.
39. $\frac{3}{7}$, $\frac{11}{14}$, and $\frac{10}{21}$.
40. $\frac{4}{5}$, $\frac{1}{6}$, and $\frac{5}{8}$.
41. $\frac{5}{16}$, $\frac{5}{12}$, and $\frac{5}{48}$.
42. $\frac{8}{15}$, $\frac{11}{12}$, and $\frac{7}{8}$.
43. $\frac{7}{9}$, $\frac{23}{24}$, and $\frac{29}{36}$.
44. $\frac{5}{8}$, $\frac{9}{14}$, and $\frac{9}{28}$.
45. $\frac{8}{15}$, $\frac{11}{80}$, and $\frac{9}{40}$.

46. Find the sum of $13\frac{1}{2}$, $15\frac{3}{4}$, and $18\frac{5}{6}$.

PROCESS.

$$\begin{array}{ll} 13\frac{1}{2} & \frac{6}{12} \\ 15\frac{3}{4} & \frac{9}{12} \\ 18\frac{5}{6} & \frac{10}{12} \\ \hline 48\frac{1}{12},\ \textit{Ans.} & \frac{25}{12} = 2\frac{1}{12} \end{array}$$

We add the fractions first: $\frac{1}{2} + \frac{3}{4} + \frac{5}{6} = 2\frac{1}{12}$. Write $\frac{1}{12}$ under the fractions, and add the 2 to the whole numbers. $2 + 18 + 15 + 13 = 48$; hence the sum is $48\frac{1}{12}$.

Add—

47. $8\frac{1}{2}$, $10\frac{5}{6}$, and $14\frac{3}{4}$.
48. $22\frac{1}{3}$, $42\frac{1}{2}$, and $60\frac{2}{3}$.
49. $102\frac{5}{6}$, $204\frac{7}{8}$, and $90\frac{5}{12}$.
50. $415\frac{2}{3}$, $516\frac{7}{8}$, and $112\frac{7}{12}$.
51. $16\frac{1}{2}$, $22\frac{2}{3}$, $45\frac{7}{8}$, and $50\frac{5}{16}$.

52. A lady bought $5\frac{1}{2}$ yards of muslin at one store, $10\frac{3}{4}$ yards at another, and $12\frac{3}{8}$ yards at a third; how many yards did she buy at the three stores?

53. An agent charged \$$216\frac{1}{2}$ for traveling expenses, \$$66\frac{3}{4}$ for boarding, and \$$50\frac{1}{2}$ for freight; what were his entire expenses?

54. A traveled $22\frac{1}{2}$ miles on Monday, $25\frac{3}{4}$ miles on Tuesday, and $31\frac{3}{8}$ miles on Wednesday; how far did he travel in all?

55. A farmer sold a load of hay for \$$12\frac{1}{2}$, a load of oats for \$$22\frac{3}{4}$, and a load of wheat for \$$102\frac{1}{4}$; how much did he receive for all?

SUBTRACTION OF FRACTIONS.

ORAL EXERCISES.

51.—*1.* How much is $\frac{3}{5}$ less $\frac{1}{5}$? $\frac{5}{7}$ less $\frac{2}{7}$?
2. How much is $\frac{7}{8}$ less $\frac{3}{8}$? $\frac{6}{11}$ less $\frac{4}{11}$?
3. How much is $\frac{11}{13}$ less $\frac{5}{13}$? $\frac{8}{15}$ less $\frac{7}{15}$?
4. How much is $\frac{12}{19}$ less $\frac{4}{19}$? $\frac{16}{21}$ less $\frac{8}{21}$?
5. How much is $\frac{17}{25}$ less $\frac{8}{25}$? $\frac{18}{31}$ less $\frac{9}{31}$?
6. How much is $\frac{12}{13}$ less $\frac{9}{13}$? $\frac{14}{23}$ less $\frac{9}{23}$?
7. What is the difference between $\frac{1}{2}$ and $\frac{1}{3}$?

We cannot subtract these fractions as they are; therefore we must reduce them to a common denominator.

$\frac{1}{2} = \frac{3}{6}$ and $\frac{1}{3} = \frac{2}{6}$; $\frac{3}{6} - \frac{2}{6} = \frac{1}{6}$, *Ans.*

To subtract fractions they must have a common denominator.

Subtract—

8. $\frac{1}{4}$ from $\frac{1}{2}$.
9. $\frac{1}{4}$ from $\frac{1}{3}$.
10. $\frac{1}{5}$ from $\frac{1}{4}$.
11. $\frac{1}{7}$ from $\frac{1}{6}$.
12. $\frac{1}{7}$ from $\frac{1}{4}$.
13. $\frac{1}{9}$ from $\frac{1}{3}$.
14. $\frac{1}{8}$ from $\frac{1}{5}$.
15. $\frac{1}{6}$ from $\frac{1}{5}$.

WRITTEN EXERCISES.

16. Subtract $\frac{5}{6}$ from $\frac{7}{8}$.

PROCESS.—$\frac{7}{8} - \frac{5}{6} = \frac{21}{24} - \frac{20}{24} = \frac{1}{24}$, *Ans.*

Reducing the fractions to a common denominator, we have $\frac{7}{8} = \frac{21}{24}$ and $\frac{5}{6} = \frac{20}{24}$; the difference between 21 twenty-fourths and 20 twenty-fourths is 1 twenty-fourth, or $\frac{1}{24}$.

What is—

17. $\frac{2}{7} - \frac{2}{9}$?
18. $\frac{3}{4} - \frac{2}{3}$?
19. $\frac{7}{12} - \frac{2}{9}$?
20. $\frac{4}{5} - \frac{8}{15}$?
21. $\frac{8}{15} - \frac{3}{10}$?
22. $\frac{2}{3} - \frac{9}{14}$?
23. $\frac{5}{7} - \frac{7}{15}$?
24. $\frac{7}{8} - \frac{5}{9}$?
25. $\frac{13}{12} - \frac{12}{13}$?
26. $\frac{11}{12} - \frac{10}{11}$?

27. $\frac{8}{21} - \frac{5}{14}$?
28. $\frac{20}{21} - \frac{13}{35}$?
29. $\frac{40}{76} - \frac{8}{19}$?
30. $\frac{18}{25} - \frac{16}{75}$?
31. $\frac{11}{18} - \frac{11}{63}$?
32. $\frac{15}{16} - \frac{12}{18}$?

33. Subtract $7\frac{1}{3}$ from $8\frac{1}{2}$.

PROCESS.

$8\frac{1}{2}$ $\frac{3}{6}$
$7\frac{1}{3}$ $\frac{2}{6}$
$1\frac{1}{6}$, *Ans.* $\frac{1}{6}$

We subtract the fractions first, $\frac{1}{2} - \frac{1}{3} = \frac{1}{6}$; write the $\frac{1}{6}$ under the fractions and then subtract the whole numbers.

What is—

34. $6\frac{1}{2} - 4\frac{1}{3}$?
35. $10\frac{2}{3} - 5\frac{1}{2}$?
36. $11\frac{5}{6} - 2\frac{2}{3}$?
37. $18\frac{7}{8} - 10\frac{1}{3}$?
38. $25\frac{9}{10} - 12\frac{2}{3}$?
39. $34\frac{11}{12} - 16\frac{1}{5}$?
40. $42\frac{13}{14} - 20\frac{5}{6}$?
41. $50\frac{2}{3} - 16\frac{1}{6}$?
42. $60\frac{1}{3} - 14\frac{2}{3}$?
43. $80\frac{1}{2} - 20\frac{5}{8}$?
44. $81\frac{2}{3} - 25\frac{7}{8}$?
45. $96\frac{1}{2} - 32\frac{5}{14}$?
46. $62\frac{1}{2} - 33\frac{5}{6}$?
47. $47\frac{2}{11} - 13\frac{9}{13}$?
48. $16\frac{3}{16} - 8\frac{5}{16}$?
49. $20\frac{1}{7} - 8\frac{3}{16}$?

50. A farmer bought a cow for \$$20\frac{1}{2}$ and a sheep for \$$8\frac{3}{4}$; how much more did he pay for the cow than for the sheep?

51. A teacher's salary is \$$135\frac{7}{10}$ a month; how much does he save a month if his average expenses are \$$51\frac{7}{8}$?

52. A drover bought 7 horses at an average price of \$$150\frac{5}{7}$ a head, and sold them at the rate of \$$165\frac{6}{7}$ a head; what was the average gain on one horse?

53. A grain-dealer bought wheat at $60\frac{7}{8}$ cents a bushel, and sold it at $61\frac{3}{9}$ cents a bushel; what was the gain on one bushel?

PROBLEMS

In Addition and Subtraction of Fractions.

1. From the sum of $\frac{1}{2}$ and $\frac{2}{3}$ take $\frac{3}{4}$.

2. From the sum of $\frac{2}{3}$ and $\frac{5}{7}$ take $\frac{7}{8}$.

3. From the sum of $\frac{1}{2}$ and $\frac{7}{9}$ take $\frac{2}{3}$.

4. To the difference between $\frac{1}{5}$ and $\frac{1}{6}$ add $\frac{5}{12}$.

5. To $\frac{3}{4} + \frac{7}{11}$ add $\frac{1}{2} - \frac{1}{3}$.

6. From $\frac{7}{18} + \frac{6}{9}$ take $\frac{1}{2} - \frac{1}{4}$.

7. From $\frac{1}{3} + \frac{1}{4} + \frac{1}{5}$ take $\frac{5}{12} - \frac{1}{3}$.

8. From 2 take $\frac{7}{12} - \frac{5}{21}$.

9. Find the value of $\frac{2}{3} - \frac{1}{2} + \frac{3}{4} - \frac{1}{5}$.

10. Find the value of $\frac{7}{8} + \frac{5}{7} - \frac{1}{2} - \frac{3}{14}$.

11. To $16\frac{2}{3} - 5\frac{11}{12}$ add $14\frac{2}{3} + 8\frac{7}{15}$.

12. From $1\frac{2}{3} + 3\frac{2}{7}$ take $2\frac{5}{21} - \frac{6}{7}$.

13. A farmer raised 800 bushels of wheat, corn, and rye; how much wheat did he raise if there were $108\frac{1}{2}$ bushels of rye and $257\frac{3}{4}$ bushels of corn?

14. A miller had $250\frac{1}{2}$ bushels of wheat: after buying $316\frac{3}{4}$ bushels, he sold $426\frac{1}{2}$ bushels; how much remained?

FRACTIONAL PARTS OF INTEGERS.

ORAL EXERCISES.

52.—*1.* What is $\frac{1}{2}$ of 4? $\frac{1}{2}$ of 6? $\frac{1}{2}$ of 16?

2. What is $\frac{1}{3}$ of 6? Of 9? Of 15? Of 18?

3. What is $\frac{1}{4}$ of 12? Of 16? Of 20? Of 36?

4. What is $\frac{2}{3}$ of 6? Of 9? Of 12? Of 18?

5. What is $\frac{3}{4}$ of 12? Of 16? Of 20? Of 28?

6. What is $\frac{1}{7}$ of 42? $\frac{5}{7}$ of 42? $\frac{6}{7}$ of 42?

7. What is $\frac{1}{8}$ of 64? $\frac{3}{8}$ of 64? $\frac{5}{8}$ of 64? $\frac{7}{8}$ of 64?

8. What is $\frac{1}{9}$ of 63? $\frac{4}{9}$ of 63? $\frac{5}{9}$ of 63? $\frac{7}{9}$ of 63?

9. 5 is $\frac{1}{2}$ of what number?

10. 6 is $\frac{1}{3}$ of what number?

11. 12 is $\frac{1}{5}$ of what number?

12. 10 is $\frac{1}{6}$ of what number?

13. 12 is $\frac{1}{8}$ of what number?

14. What is $\frac{1}{3}$ of 7? $\frac{1}{3}$ of 11? $\frac{1}{3}$ of 16?

15. What is $\frac{1}{5}$ of 8? $\frac{1}{5}$ of 17? $\frac{1}{5}$ of 22?

WRITTEN EXERCISES.

1. What is $\frac{5}{12}$ of 325?

Process.

$$\begin{array}{r} 325 \\ \underline{5} \\ 12\overline{)1625} \\ 135\frac{5}{12}, \textit{ Ans.} \end{array}$$

$\frac{5}{12}$ of 325 is $\frac{1}{12}$ of 5 times 325. 5 times 325 is 1625; 1625 divided by 12 is $135\frac{5}{12}$. Hence $\frac{5}{12}$ of 325 is $135\frac{5}{12}$.

2. What is $\frac{5}{7}$ of 450? $\frac{4}{9}$ of 329?
3. What is $\frac{11}{16}$ of 385? $\frac{9}{13}$ of 437?
4. What is $\frac{5}{6}$ of 125? $\frac{9}{10}$ of 316?
5. What is $\frac{5}{8}$ of 304? $\frac{5}{9}$ of 412?
6. What is $\frac{7}{12}$ of 512? $\frac{11}{12}$ of 625?
7. What is $\frac{8}{11}$ of 600? $\frac{5}{13}$ of 700?
8. What is $\frac{5}{11}$ of 3218? $\frac{6}{23}$ of 3002?
9. What is $\frac{6}{13}$ of 1235? $\frac{8}{15}$ of 1413?

10. If an acre of land is worth \$150, what is $\frac{3}{5}$ of an acre worth?

11. If a barrel of flour is worth \$8, what is $\frac{3}{4}$ of a barrel worth?

12. If a quantity of wheat is worth \$216, what is $\frac{4}{5}$ of it worth?

13. A farm valued at \$8672 was sold for $\frac{5}{8}$ of its value; what was the selling price?

14. If a barrel of apples is worth \$6, what is $\frac{7}{9}$ of a barrel worth?

15. A horse and carriage valued at \$410 were sold for $\frac{7}{8}$ of their value; what was the selling price?

16. A owns $\frac{5}{8}$ of a vessel which is valued at \$215416; what is the value of his share?

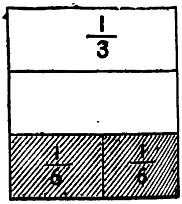
17. A railroad which cost \$500000 was sold for $\frac{11}{15}$ of its value; what was the loss?

18. A man asked \$180 for his horse, but, finding no purchaser at this price, sold him for $\frac{5}{6}$ of this sum; what did he receive for the horse?

FRACTIONAL PARTS OF FRACTIONS.

ORAL EXERCISES.

53.—*1.* What is $\frac{1}{2}$ of $\frac{1}{3}$?



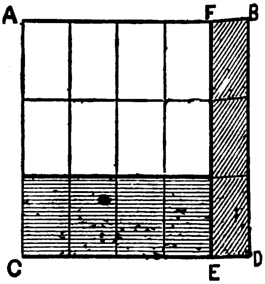
If each third of the square is divided into two equal parts, the whole square will be divided into six equal parts, and each part will be $\frac{1}{6}$ of the square. Hence $\frac{1}{2}$ of $\frac{1}{3} = \frac{1}{6}$.

2. What is $\frac{1}{3}$ of $\frac{1}{4}$? $\frac{1}{2}$ of $\frac{1}{5}$? $\frac{1}{2}$ of $\frac{1}{6}$?
3. What is $\frac{1}{3}$ of $\frac{1}{5}$? $\frac{1}{4}$ of $\frac{1}{6}$? $\frac{1}{3}$ of $\frac{1}{7}$?
4. What is $\frac{1}{5}$ of $\frac{1}{6}$? $\frac{1}{5}$ of $\frac{1}{7}$? $\frac{1}{3}$ of $\frac{1}{8}$?
5. What is $\frac{1}{7}$ of $\frac{1}{9}$? $\frac{1}{8}$ of $\frac{1}{7}$? $\frac{1}{8}$ of $\frac{1}{9}$?

6. What is $\frac{1}{2}$ of $\frac{3}{5}$?

SUGGESTION.—$\frac{1}{2}$ of $\frac{1}{5}$ is $\frac{1}{10}$, and $\frac{1}{2}$ of $\frac{3}{5}$ is $\frac{3}{10}$.

7. What is $\frac{1}{2}$ of $\frac{3}{7}$? $\frac{1}{2}$ of $\frac{5}{7}$? $\frac{1}{3}$ of $\frac{2}{3}$? $\frac{1}{3}$ of $\frac{3}{5}$? $\frac{1}{7}$ of $\frac{5}{8}$?
8. What is $\frac{1}{3}$ of $\frac{4}{9}$? $\frac{1}{3}$ of $\frac{5}{9}$? $\frac{1}{5}$ of $\frac{3}{7}$? $\frac{1}{5}$ of $\frac{9}{10}$? $\frac{1}{9}$ of $\frac{7}{8}$?
9. What is $\frac{2}{3}$ of $\frac{4}{5}$?



SUGGESTION.—Since $\frac{1}{3}$ of $\frac{4}{5}$ is $\frac{4}{15}$, $\frac{2}{3}$ of $\frac{4}{5}$ are 2 times $\frac{4}{15}$, or $\frac{8}{15}$.

From the illustration it is seen that if the square A B C D is divided into 15 equal parts, $\frac{4}{5}$ of the square, or A F C E, will contain 12 of these parts, and $\frac{2}{3}$ of these $\frac{4}{5}$ will contain $\frac{2}{3}$ of 12 parts, or 8 parts. Since each part is $\frac{1}{15}$ of the square, 8 parts are $\frac{8}{15}$ of the square; hence $\frac{2}{3}$ of $\frac{4}{5}$ equals $\frac{8}{15}$. We can obtain this result by multiplying the numerators together for the new numerator and the denominators together for the new denominator.

10. What is $\frac{3}{4}$ of $\frac{5}{7}$? $\frac{2}{3}$ of $\frac{7}{9}$? $\frac{2}{5}$ of $\frac{3}{5}$? $\frac{5}{9}$ of $\frac{2}{7}$?
11. What is $\frac{5}{6}$ of $\frac{8}{9}$? $\frac{3}{7}$ of $\frac{8}{11}$? $\frac{2}{3}$ of $\frac{5}{13}$? $\frac{3}{4}$ of $\frac{8}{11}$?
12. What is $\frac{8}{9}$ of $\frac{4}{5}$? $\frac{5}{6}$ of $\frac{7}{11}$? $\frac{4}{7}$ of $\frac{6}{11}$? $\frac{3}{11}$ of $\frac{5}{17}$?

WRITTEN EXERCISES.

13. What is $\frac{5}{7}$ of $\frac{14}{15}$?

PROCESS.

$\frac{5}{7}$ of $\frac{14}{15} = \frac{70}{105}$, or $\frac{2}{3}$

Or—

$\frac{\cancel{5}}{\cancel{7}}$ of $\frac{\overset{2}{\cancel{14}}}{\underset{3}{\cancel{15}}} = \frac{2}{3}$, *Ans.*

By multiplying as in Problem 11 we have $\frac{5}{7} \times \frac{14}{15} = \frac{70}{105}$, which by reduction is $\frac{2}{3}$.

In practice we reduce before multiplying. This is done by dividing by any number found in both terms of the fraction. Thus, 5 is taken out of 5 and 15, and 7 out of 7 and 14; the result is then $\frac{2}{3}$.

The number thus taken out is called a *Common Factor*, and the process is called *Cancellation*.

What is the value of—

14. $\frac{3}{5}$ of $\frac{5}{18}$?
15. $\frac{4}{9}$ of $\frac{18}{30}$?
16. $\frac{8}{15}$ of $\frac{15}{81}$?
17. $\frac{6}{7}$ of $\frac{14}{15}$?
18. $\frac{7}{12}$ of $\frac{12}{21}$?
19. $\frac{5}{11}$ of $\frac{17}{19}$?
20. $\frac{4}{5}$ of $\frac{9}{11}$ of $\frac{11}{18}$?
21. $\frac{2}{3}$ of $\frac{4}{5}$ of $\frac{5}{7}$?
22. $\frac{3}{4}$ of $\frac{7}{8}$ of $\frac{9}{10}$?
23. $\frac{6}{7}$ of $\frac{7}{8}$ of $\frac{9}{10}$?
24. $\frac{8}{11}$ of $\frac{12}{15}$ of $\frac{15}{24}$?
25. $\frac{9}{10}$ of $\frac{5}{17}$ of $\frac{6}{27}$?
26. $\frac{4}{9}$ of $\frac{7}{11}$ of $\frac{14}{15}$?
27. $\frac{4}{5}$ of $\frac{2}{3}$ of $\frac{7}{9}$?

MULTIPLICATION OF FRACTIONS.

54. To multiply a fraction by an integer or an integer by a fraction.

ORAL EXERCISES.

1. What is $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$? What, then, is $3 \times \frac{1}{2}$?

2. What is $\frac{5}{7} + \frac{5}{7} + \frac{5}{7}$? What, then, is $3 \times \frac{5}{7}$?

3. How may we multiply a fraction by an integer?

4. What is $\frac{5}{6} + \frac{5}{6} + \frac{5}{6}$, expressed in its lowest terms? How may this result be obtained from $\frac{5}{6}$?

5. In what other way may we multiply an integer by a fraction?

55. Hence, *multiplying the numerator or dividing the denominator of a fraction by any number, multiplies the value of the fraction by that number.*

6. What is $4 \times \frac{2}{3}$? $\frac{3}{4} \times 5$? $\frac{2}{7} \times 6$?

7. What is $7 \times \frac{5}{49}$? $8 \times \frac{7}{16}$? $9 \times \frac{7}{27}$?

8. What is $\frac{2}{7} \times 10$? $\frac{5}{33} \times 11$? $\frac{5}{24} \times 12$?

9. What is $8 \times \frac{3}{5}$? $\frac{2}{19} \times 9$? $10 \times \frac{5}{7}$?

WRITTEN EXERCISES.

10. Multiply $\frac{16}{125}$ by 25; also, 24 by $\frac{5}{8}$.

Process.

$$\cancel{25} \times \frac{16}{\underset{5}{\cancel{125}}} = \frac{16}{5} = 3\tfrac{1}{5},\ \textit{Ans.}$$

Process.

$$\frac{5}{\cancel{8}} \times \frac{\overset{3}{\cancel{24}}}{1} = 15,\ \textit{Ans.}$$

Multiply—

11. $\frac{10}{29}$ by 2.
12. $\frac{19}{32}$ by 8.
13. 3 by $\frac{3}{12}$.
14. 42 by $\frac{5}{7}$.
15. $\frac{7}{9}$ by 12.
16. $\frac{25}{63}$ by 21.
17. 8 by $\frac{43}{80}$.
18. 12 by $\frac{33}{16}$.
19. $\frac{45}{88}$ by 33.
20. $\frac{60}{144}$ by 12.
21. $\frac{18}{19}$ by 11.
22. 72 by $\frac{15}{64}$.
23. 105 by $\frac{7}{35}$.
24. 39 by $\frac{5}{11}$.
25. $\frac{23}{72}$ by 24.
26. 216 by $\frac{5}{27}$.
27. 42 by $\frac{4}{9}$.
28. 208 by $\frac{9}{13}$.
29. $\frac{7}{17}$ by 305.
30. $\frac{12}{13}$ by 169.
31. $\frac{11}{23}$ by 285.
32. 196 by $\frac{15}{28}$.
33. $\frac{5}{18}$ by 3.
34. 18 by $\frac{2}{37}$.
35. $\frac{99}{100}$ by 10.
36. 8 by $\frac{4}{121}$.
37. $\frac{1}{128}$ by 56.
38. 3 by $\frac{1}{1760}$.
39. 205 by $\frac{2}{33}$.
40. $\frac{2}{63}$ by 51.
41. 9 by $\frac{1}{9}$.
42. $\frac{1}{15}$ by 45.
43. $\frac{16}{19}$ by 38.

44. Multiply 105 by $6\frac{2}{3}$.

Process.

$$\begin{array}{rl} 105 & \\ \underline{6\frac{2}{3}} & \\ 70 & = \frac{2}{3} \text{ of } 105 \\ \underline{630} & = 6 \times 105 \\ 700, & \textit{Ans.} \end{array}$$

We multiply first by the fraction, and then by the integer. $\frac{2}{3}$ of 105 is 70, and 6 times 105 is 630. Adding 70 and 630, we have 700; hence $6\frac{2}{3} \times 105 = 700$.

Multiply—

45. 32 by $12\frac{1}{2}$.	*53.* 8 by $27\frac{15}{16}$.
46. 35 by $15\frac{5}{7}$.	*54.* $63\frac{21}{80}$ by 40.
47. 81 by $16\frac{7}{9}$.	*55.* 48 by $20\frac{5}{7}$.
48. $16\frac{2}{3}$ by 25.	*56.* $512\frac{16}{31}$ by 5.
49. $12\frac{3}{4}$ by 47.	*57.* $6\frac{5}{7}$ by 122.
50. $42\frac{3}{5}$ by 9.	*58.* 64 by $16\frac{3}{4}$.
51. 151 by $4\frac{8}{15}$.	*59.* $40\frac{2}{9}$ by 20.
52. $11\frac{5}{12}$ by 108.	*60.* 135 by $9\frac{4}{9}$.

61. If a ton of coal costs \$5 and a stove $3\frac{2}{5}$ times as much, what is the cost of the stove?

62. What will 16 pounds of butter cost at $28\frac{1}{2}$ cents a pound?

63. If a dozen of eggs cost $12\frac{3}{4}$ cents, what will 32 dozen cost?

64. At \$8 a yard, what is the cost of $21\frac{3}{8}$ yards of cloth?

65. If a horse costs \$$175\frac{3}{4}$, what will a drove of 24 horses cost at the same rate?

66. A paid \$$16\frac{1}{2}$ for a set of harness and 20 times as much for a horse; what did both cost?

56. To multiply a fraction by a fraction.

1. Multiply $\frac{2}{3}$ by $\frac{5}{7}$.

PROCESS.
$\frac{5}{7} \times \frac{2}{3} = \frac{10}{21}$

To multiply $\frac{2}{3}$ by $\frac{5}{7}$ is to find $\frac{5}{7}$ of $\frac{2}{3}$, which by ART. 53 is found by multiplying the numerators together for the numerator, and the denominators together for the denominator. Hence $\frac{5}{7} \times \frac{2}{3} = \frac{10}{21}$.

2. Find the product of $\frac{16}{27} \times \frac{9}{8} \times \frac{21}{10}$.

PROCESS.—$$\frac{\overset{2}{\cancel{16}}}{\underset{3}{\cancel{27}}} \times \frac{\cancel{9}}{\cancel{8}} \times \frac{\overset{7}{\cancel{21}}}{\underset{5}{\cancel{10}}} = \frac{7}{5} = 1\frac{2}{5}, \textit{ Ans.}$$

Multiply—

3. $\frac{2}{3}$ by $\frac{7}{9}$.
4. $\frac{3}{5}$ by $\frac{14}{25}$.
5. $\frac{8}{9}$ by $\frac{12}{20}$.
6. $\frac{15}{17}$ by $\frac{11}{27}$.
7. $\frac{21}{24}$ by $\frac{8}{9}$.
8. $\frac{25}{7}$ by $\frac{49}{40}$.
9. $\frac{12}{17}$ by $\frac{5}{12}$.
10. $\frac{11}{25}$ by $\frac{65}{44}$.
11. $\frac{18}{16}$ by $\frac{48}{65}$.
12. $\frac{15}{32}$ by $\frac{55}{56}$.
13. $\frac{21}{36}$ by $\frac{45}{49}$.
14. $\frac{20}{81}$ by $\frac{63}{50}$.
15. $\frac{11}{48}$ by $\frac{80}{99}$.
16. $\frac{24}{39}$ by $\frac{91}{132}$.
17. $\frac{13}{14}$ by $\frac{11}{15}$.
18. $\frac{23}{57}$ by $\frac{38}{42}$.
19. $\frac{9}{16}$ by $\frac{81}{48}$.
20. $\frac{13}{32}$ by $\frac{16}{39}$.
21. $\frac{60}{77}$ by $\frac{99}{144}$.
22. $\frac{17}{22}$ by $\frac{39}{102}$.
23. $\frac{42}{120}$ by $\frac{56}{91}$.

The word *of* between two fractions is equivalent to the *sign of multiplication*. Thus, $\frac{2}{3}$ of $\frac{3}{4} = \frac{3}{4} \times \frac{2}{3}$. Such expressions are called *Compound Fractions.*

Find the value of—

24. $\frac{7}{8}$ of $\frac{32}{126}$ of $\frac{65}{87}$.
25. $\frac{4}{5}$ of $\frac{7}{12}$ of $\frac{8}{35}$ of $\frac{25}{32}$.
26. $\frac{3}{4}$ of $\frac{9}{15}$ of $\frac{11}{12}$ of $1\frac{2}{3}$.
27. $\frac{24}{35}$ of $\frac{25}{16}$ of $\frac{16}{50}$ of $\frac{49}{75}$ of $\frac{57}{19}$.
28. $\frac{45}{51}$ of $\frac{17}{40}$ of $\frac{9}{25}$ of $\frac{10}{11}$ of $\frac{4}{25}$.

29. Multiply $4\frac{2}{3}$ by $8\frac{2}{5}$.

SUGGESTION.—$4\frac{2}{3} \times 8\frac{2}{5} = \frac{14}{\cancel{3}} \times \frac{\overset{14}{\cancel{42}}}{5} = \frac{196}{5} = 39\frac{1}{5}$, *Ans.*

30. Multiply $12\frac{1}{2}$ by $7\frac{2}{3}$. Multiply $16\frac{2}{3}$ by $5\frac{2}{7}$.
31. Multiply $20\frac{1}{4}$ by $5\frac{7}{9}$. Multiply $5\frac{3}{4}$ by $2\frac{2}{25}$.
32. Multiply $62\frac{1}{2}$ by $4\frac{4}{25}$. Multiply $12\frac{4}{5}$ by $1\frac{7}{8}$.
33. What will $5\frac{1}{4}$ tons of coal cost at \$$5\frac{3}{4}$ a ton?
34. When wood is worth \$$6\frac{1}{4}$ a cord, what will $\frac{2}{3}$ of a cord cost?
35. What will $\frac{7}{8}$ of a ton of hay cost at \$$9\frac{3}{5}$ a ton?
36. There are $16\frac{1}{2}$ feet in a rod; how many feet in $5\frac{1}{2}$ rods?
37. There are $24\frac{3}{4}$ cubic feet in a perch of stone; how many cubic feet in $5\frac{3}{11}$ perches?
38. How many square yards in $12\frac{4}{11}$ perches of land, if there are $30\frac{1}{4}$ square yards in a perch?

DIVISION OF FRACTIONS.

57. To divide a fraction by an integer.

ORAL EXERCISES.

1. If 4 times $\frac{2}{3}$ are $\frac{8}{3}$, what is $\frac{8}{3}$ divided by 4?

2. If 5 times $\frac{3}{7}$ are $\frac{15}{7}$, what is $\frac{15}{7}$ divided by 5?

3. If 6 times $\frac{5}{11}$ are $\frac{30}{11}$, what is $\frac{30}{11}$ divided by 6?

4. How, then, may we divide a fraction by an integer?

5. If 5 times $\frac{2}{15}$ are $\frac{2}{3}$, what is $\frac{2}{3}$ divided by 5?

6. If 6 times $\frac{5}{18}$ are $\frac{5}{3}$, what is $\frac{5}{8}$ divided by 6?

7. If 7 times $\frac{2}{21}$ are $\frac{2}{3}$, what is $\frac{2}{3}$ divided by 7?

8. In what other way besides dividing the numerator may we divide a fraction by an integer?

58. Hence, *dividing the numerator or multiplying the denominator of a fraction by any number, divides the value of the fraction by that number.*

9. Divide $\frac{16}{7}$ by 4. $\frac{22}{9}$ by 11. $\frac{36}{7}$ by 6.

10. Divide $\frac{63}{17}$ by 9. $\frac{56}{5}$ by 7. $\frac{72}{11}$ by 8.

11. Divide $\frac{5}{7}$ by 4. $\frac{3}{5}$ by 7. $\frac{2}{3}$ by 9.

12. Divide $\frac{7}{9}$ by 5. $\frac{8}{3}$ by 6. $\frac{3}{4}$ by 7.

13. Divide $\frac{5}{11}$ by 3. $\frac{8}{7}$ by 9. $\frac{5}{6}$ by 3.

14. If 6 books cost \$$\frac{18}{10}$, what will one book cost?

15. If 4 yards of muslin cost \$$\frac{1}{2}$, what will one yard cost?

16. If 5 pounds of coffee cost \$$\frac{3}{2}$, what will one pound cost?

17. A boy walked $\frac{27}{4}$ miles in 3 hours; what was the average rate per hour?

18. If 9 bushels of apples cost \$$\frac{32}{5}$, what will one bushel cost?

19. If 11 pounds of butter cost \$$\frac{22}{5}$, what will one pound cost?

20. There are 4 pecks in a bushel; how many bushels in 24 half-pecks?

WRITTEN EXERCISES.

21. Divide $\frac{125}{12}$ by 25; also by 11.

PROCESS.—$\frac{125}{12} \div 25 = \frac{5}{12}$, *Ans.* $\frac{125}{12} + 11 = \frac{125}{132}$, *Ans.*

Divide—

22. $\frac{12}{5}$ by 4.
23. $\frac{16}{25}$ by 8.
24. $\frac{35}{49}$ by 5.
25. $\frac{81}{16}$ by 9.
26. $\frac{121}{135}$ by 11.
27. $\frac{196}{201}$ by 14.
28. $\frac{216}{45}$ by 27.
29. $\frac{17}{19}$ by 11.
30. $\frac{18}{25}$ by 12.
31. $\frac{35}{37}$ by 13.
32. $\frac{441}{17}$ by 21.
33. $\frac{27}{19}$ by 23.
34. $\frac{88}{93}$ by 11.
35. $\frac{243}{513}$ by 27.
36. $\frac{625}{51}$ by 25.

37. Divide $586\frac{2}{3}$ by 7.

PROCESS.
$7\underline{)586\frac{2}{3}}$
$83\frac{17}{21}$, *Ans.*

Dividing 586 by 7, we have 83, with 5 remaining; 5 equals $\frac{15}{3}$, which added to $\frac{2}{3}$ make $\frac{17}{3}$; $\frac{17}{3}$ divided by 7 equals $\frac{17}{21}$. Hence the quotient is $83\frac{17}{21}$.

Divide—

38. $25\frac{2}{3}$ by 6.
39. $87\frac{1}{2}$ by 12.
40. $42\frac{5}{7}$ by 18.
41. $5\frac{1}{3}$ by 17.
42. $37\frac{1}{2}$ by 15.
43. $62\frac{1}{2}$ by 25.
44. $33\frac{3}{4}$ by 27.
45. $44\frac{4}{5}$ by 32.
46. $46\frac{6}{7}$ by 41.
47. $4\frac{3}{5}$ by 5.
48. $936\frac{3}{8}$ by 7.
49. $1001\frac{5}{7}$ by 11.
50. $4380\frac{5}{8}$ by 9.
51. $5020\frac{4}{5}$ by 8.
52. $3854\frac{2}{3}$ by 12.
53. $125\frac{5}{7}$ by 15.

59. To divide an integer by a fraction, or a fraction by a fraction.

1. Divide 2 by $\frac{5}{2}$; also, $\frac{2}{3}$ by $\frac{5}{7}$.

PROCESS.
$2 \div \frac{5}{2} = 2 \times \frac{2}{5} = \frac{4}{5}$, *Ans.*

PROCESS.
$\frac{2}{3} + \frac{5}{7} = \frac{2}{3} \times \frac{7}{5} = \frac{14}{15}$, *Ans.*

In this case we *invert the divisor and multiply.*
Use cancellation when possible.

Divide—

2. 10 by $\frac{5}{6}$.
3. 16 by $\frac{8}{9}$.
4. 46 by $\frac{4}{5}$.
5. 36 by $\frac{9}{13}$.
6. 18 by $\frac{7}{8}$.
7. $\frac{3}{10}$ by $\frac{5}{7}$.
8. $\frac{7}{9}$ by $\frac{2}{5}$.
9. $\frac{4}{11}$ by $\frac{3}{7}$.
10. $\frac{7}{8}$ by $\frac{5}{12}$.
11. $\frac{9}{10}$ by $\frac{3}{4}$.
12. 210 by $\frac{21}{8}$.
13. $\frac{11}{12}$ by $\frac{8}{9}$.
14. 87 by $\frac{14}{15}$.
15. $\frac{48}{35}$ by $\frac{72}{105}$.
16. 101 by $\frac{17}{18}$.
17. $\frac{32}{63}$ by $\frac{28}{81}$.
18. $\frac{56}{65}$ by $\frac{77}{45}$.
19. $\frac{42}{72}$ by $\frac{18}{27}$.
20. $\frac{96}{121}$ by $\frac{27}{88}$.
21. 231 by $\frac{77}{80}$.
22. 441 by $\frac{21}{22}$.
23. $\frac{125}{147}$ by $\frac{110}{84}$.
24. $\frac{91}{111}$ by $\frac{21}{37}$.
25. 516 by $\frac{5}{9}$.
26. $\frac{64}{81}$ by $\frac{10}{19}$.
27. $\frac{85}{121}$ by $\frac{17}{10}$.
28. 606 by $\frac{8}{9}$.
29. $\frac{105}{144}$ by $\frac{245}{432}$.
30. 1234 by $\frac{9}{10}$.
31. $\frac{169}{196}$ by $\frac{91}{140}$.
32. $\frac{361}{512}$ by $\frac{19}{24}$.
33. 301 by $\frac{21}{113}$.
34. $\frac{576}{625}$ by $\frac{48}{125}$.

35. Divide $42\frac{2}{3}$ by $8\frac{5}{6}$.

PROCESS.

$$42\tfrac{2}{3} = \tfrac{128}{3};\ 8\tfrac{5}{6} = \tfrac{53}{6}.$$

$$\tfrac{128}{3} \div \tfrac{53}{6} = \frac{128}{\cancel{3}} \times \frac{\overset{2}{\cancel{6}}}{53} = \tfrac{256}{53} = 4\tfrac{44}{53},\ \textit{Ans.}$$

36. Divide $32\frac{5}{6}$ by $18\frac{2}{3}$.
37. Divide $125\frac{1}{2}$ by $62\frac{2}{5}$.
38. Divide $2\frac{3}{4} \times 3\frac{4}{7}$ by $6\frac{1}{2} \times 11\frac{3}{8}$.
39. Divide $12\frac{1}{2} \times 16\frac{2}{3}$ by $6\frac{1}{3} \times 5\frac{3}{4}$.
40. Divide $4\frac{2}{3} \times 6\frac{4}{7} \times 3\frac{5}{9}$ by $5\frac{1}{3} \times 3\frac{2}{7} \times 2\frac{1}{3}$.

41. A man earns \$$2\frac{1}{2}$ a day; how long must he labor to earn \$75?

42. At \$$6\frac{3}{4}$ a head, how many sheep can be bought for \$270?

43. How many books at \$$3\frac{1}{4}$ apiece can be bought for \$$81\frac{1}{4}$?

44. If a hat costs \$$2\frac{1}{4}$, how many hats can be purchased for \$81?

45. How many quarts of berries at $8\frac{3}{4}$ cents a quart can be bought for $306\frac{1}{4}$ cents?

REVIEW PROBLEMS.

Reduce to mixed numbers—

1. $\frac{170}{13}$.
2. $\frac{213}{14}$.
3. $\frac{307}{15}$.
4. $\frac{379}{16}$.
5. $\frac{583}{17}$.
6. $\frac{773}{18}$.
7. $\frac{1080}{82}$.
8. $\frac{4645}{91}$.
9. $\frac{1728}{415}$.
10. $\frac{3215}{402}$.
11. $\frac{5000}{325}$.
12. $\frac{16824}{582}$.

Reduce to improper fractions—

13. $9\frac{9}{10}$.
14. $8\frac{11}{12}$.
15. $13\frac{5}{7}$.
16. $15\frac{14}{15}$.
17. $31\frac{30}{31}$.
18. $62\frac{11}{12}$.
19. $125\frac{8}{9}$.
20. $82\frac{63}{161}$.
21. $14\frac{212}{213}$.
22. $316\frac{11}{12}$.
23. $202\frac{12}{37}$.
24. $400\frac{316}{401}$.

Reduce to lowest terms—

25. $\frac{132}{144}$.
26. $\frac{121}{143}$.
27. $\frac{160}{208}$.
28. $\frac{180}{300}$.
29. $\frac{315}{405}$.
30. $\frac{320}{448}$.
31. $\frac{372}{403}$.
32. $\frac{480}{512}$.
33. $\frac{624}{720}$.
34. $\frac{280}{294}$.
35. $\frac{295}{885}$.
36. $\frac{448}{456}$.

Find the value of—

37. $\frac{3}{5} + \frac{7}{8}$.
38. $\frac{3}{11} + \frac{5}{22}$.
39. $\frac{5}{8} + \frac{11}{20}$.
40. $\frac{11}{18} + \frac{19}{27}$.
41. $\frac{50}{77} + \frac{63}{88}$.
42. $\frac{5}{7} + \frac{8}{9} + \frac{14}{63}$.
43. $16\frac{5}{6} + 22\frac{7}{8}$.
44. $21\frac{4}{5} + 17\frac{8}{9}$.
45. $50\frac{11}{12} + 32\frac{7}{8}$.
46. $42\frac{11}{12} + 62\frac{81}{108}$.
47. $\frac{2}{3} + \frac{3}{4} + \frac{4}{5}$.
48. $\frac{5}{6} + \frac{7}{8} + \frac{9}{10}$.

Find the value of—

49. $\frac{11}{12} - \frac{2}{15}$.
50. $\frac{15}{16} - \frac{5}{48}$.
51. $\frac{13}{14} - \frac{13}{21}$.
52. $12\frac{5}{6} - 8\frac{2}{3}$.
53. $15\frac{7}{8} - 10\frac{1}{3}$.
54. $22\frac{2}{3} - 13\frac{3}{10}$.
55. $12\frac{2}{3} - 8\frac{5}{6}$.
56. $62\frac{1}{3} - 40\frac{8}{9}$.
57. $102\frac{2}{5} - 81\frac{9}{10}$.
58. $\frac{2}{3} + \frac{3}{4} - \frac{5}{6}$.
59. $\frac{5}{7} + \frac{7}{8} - \frac{8}{9}$.
60. $\frac{9}{10} + \frac{10}{11} - \frac{11}{12}$.

Find the value of—

61. $6\frac{2}{3} \times 9$.
62. $8\frac{4}{5} \times 12$.
63. $\frac{42}{121} \times 11$.
64. $\frac{102}{103} \times 13$.
65. $\frac{141}{361} \times 19$.
66. $12\frac{1}{2} \times 5\frac{1}{2}$.

67. $5\frac{2}{3} \times 8\frac{5}{6}$.
68. $162\frac{5}{9} \times 10$.
69. $25\frac{3}{5} \times 15$.
70. $\frac{5}{7} \times \frac{8}{10} \times \frac{14}{16}$.
71. $\frac{11}{12} \times \frac{15}{16} \times \frac{18}{22}$.
72. $\frac{15}{22} \times \frac{18}{25} \times \frac{44}{75}$.

Find the value of—

73. $\frac{25}{37} \div 5$.
74. $\frac{16}{17} \div 5$.
75. $4 \div \frac{12}{19}$.
76. $24 \div \frac{8}{9}$.
77. $6\frac{2}{3} \div 10$.
78. $125\frac{3}{5} \div 12$.

79. $64 \div 8\frac{2}{5}$.
80. $84 \div 10\frac{2}{7}$.
81. $\frac{12}{35} \div 6\frac{2}{3}$.
82. $8\frac{6}{7} \div \frac{31}{49}$.
83. $\frac{121}{144} \div \frac{143}{156}$.
84. $\frac{26}{150} \div \frac{50}{60}$.

Find the value of—

85. $\frac{5}{8}$ of 640.
86. $\frac{11}{12}$ of 120.
87. $\frac{6}{7}$ of 725.
88. $\frac{5}{8}$ of 542.
89. $\frac{5}{6}$ of $\frac{18}{25}$.
90. $\frac{2}{3}$ of $7\frac{1}{5}$.
91. $\frac{7}{8}$ of $5\frac{5}{7}$.
92. $6\frac{2}{3}$ of $7\frac{2}{3}$.

93. $\frac{15}{16}$ of $\frac{24}{25}$.
94. $\frac{13}{18}$ of $\frac{54}{39}$.
95. $6\frac{1}{4} \div 9\frac{3}{8}$.
96. $16\frac{2}{3} \div 12$.
97. $\frac{24}{25}$ of $\frac{125}{168}$.
98. $48 \div 16\frac{1}{2}$.
99. $420 \div 33\frac{1}{2}$.
100. $500 \div 66\frac{2}{3}$.

PRACTICAL PROBLEMS.

1. What will 12 oranges cost at $2\frac{1}{2}$ cents apiece?

2. What will $12\frac{1}{4}$ pounds of butter cost at 30 cents a pound?

3. What will $5\frac{3}{4}$ yards of muslin cost at $6\frac{1}{4}$ cents a yard?

4. What will 24 barrels of flour cost at \$$6\frac{3}{4}$ a barrel?

5. What will 12 acres of land cost at \$$80\frac{1}{2}$ an acre?

6. What will 8 pairs of rubbers cost at \$$\frac{7}{10}$ a pair?

7. What will $16\frac{1}{2}$ dozen of eggs cost at $28\frac{1}{3}$ cents a dozen?

8. What will $\frac{2}{3}$ of 5 pounds of raisins cost at $16\frac{1}{2}$ cents a pound?

9. John found that after spending $\$18\frac{2}{3}$ he had $\$42\frac{3}{4}$ remaining; how much had he at first?

10. A girl was sent to the store with \$5: she bought $15\frac{1}{2}$ yards of ribbon at 16 cents a yard; the clerk gave her \$2.50 change; how much did she lose?

11. A man earned $\$75\frac{3}{4}$ and then had $\$112\frac{5}{6}$; how much had he at first?

12. At $6\frac{2}{3}$ cents a yard, how many yards of calico can be bought for 75 cents?

13. At $\$51\frac{1}{2}$ an acre, how many acres of land can be bought for $\$725\frac{1}{3}$?

14. When sheep are worth $\$8\frac{1}{6}$ a head, how many sheep can be bought for \$2450?

15. If a newsboy earns $\$4\frac{3}{5}$ a week, how long will it require him to earn \$115?

16. A divided $\$216\frac{4}{5}$ equally among 5 poor families; how much did each family receive?

17. A divided 108 apples equally among his classmates, giving each one $6\frac{3}{4}$ apples; how many classmates had he?

18. At $\$6\frac{1}{2}$ a ton, what will $28\frac{1}{4}$ tons of coal cost?

ARITHMETICAL ANALYSIS.

60. To pass from one integer to another integer.

1. If 5 apples cost $17\frac{1}{2}$ cents, what will 9 apples cost at the same rate?

PROCESS.
5 cost $17\frac{1}{2}$ cents.
1 " $3\frac{1}{2}$ "
9 " $31\frac{1}{2}$ " *Ans.*

If 5 apples cost $17\frac{1}{2}$ cents, 1 apple costs $\frac{1}{5}$ of $17\frac{1}{2}$ cents, which is $3\frac{1}{2}$ cents, and 9 apples will cost 9 times $3\frac{1}{2}$ cents, or $31\frac{1}{2}$ cents.

2. If 9 pounds of sugar cost $58\frac{1}{2}$ cents, what will 13 pounds cost at the same rate?

3. What must I pay for 31 yards of cloth at the rate of 7 yards for \$61$\frac{3}{5}$?

4. If 9 hens cost \$2.70, what will 41 hens cost at the same rate?

5. If 4 hats cost \$14$\frac{2}{5}$, what will 21 hats cost at the same rate?

6. If 5 tons of hay cost \$31$\frac{1}{2}$, what will 9 tons cost at the same rate?

7. Find the cost of 34 barrels of oil at the rate of 8 barrels for \$24.40.

8. What will 15 loads of stone cost at the rate of 8 loads for \$17?

9. What must I pay for 18 acres of land at the rate of 5 acres for \$506$\frac{1}{4}$?

61. To pass from an integer to a fraction.

1. If a ton of coal cost \$8, what will $\frac{3}{4}$ of a ton cost?

PROCESS.
1 cost \$8
$\frac{1}{4}$ " \$2
$\frac{3}{4}$ " \$6, *Ans.*

If 1 ton of coal cost \$8, $\frac{1}{4}$ of a ton will cost $\frac{1}{4}$ of \$8, which is \$2; and $\frac{3}{4}$ of a ton will cost 3 times \$2, which are \$6.

2. What will $\frac{2}{3}$ of a barrel of apples cost at \$6 a barrel?

3. If 8 pounds of coffee cost \$2.40, what will $\frac{3}{4}$ of a pound cost?

4. If 5 yards of cloth cost \$7.50, what will $\frac{3}{5}$ of a yard cost?

5. What will $\frac{3}{4}$ of a pound of tea cost at the rate of 11 pounds for \$8.80?

6. What will $\frac{3}{5}$ of a cord of wood cost at the rate of 7 cords for \$15?

7. A paid \$1.65 for 10 pounds of beef; what would $\frac{5}{8}$ of a pound cost at the same rate?

8. If 4 pounds of rice cost 30 cents, what will $\frac{3}{5}$ of a pound cost?

62. To pass from a fraction to an integer.

1. If $\frac{2}{3}$ of a yard of cloth cost $8, what will 1 yard cost?

PROCESS.
$\frac{2}{3}$ cost $8
$\frac{1}{3}$ " $4
$\frac{3}{3}$ " $12

If $\frac{2}{3}$ of a yard of cloth cost $8, $\frac{1}{3}$ of a yard will cost $\frac{1}{2}$ of $8, which is $4, and $\frac{3}{3}$ of a yard will cost 3 times $4, which are $12.

2. What will a ton of ore cost if $\frac{4}{5}$ of a ton is sold for $16?

3. If $\frac{5}{16}$ of A's money is $1250, what is his money?

4. B sold $\frac{2}{3}$ of his farm for $9600; what was the value of his farm?

5. What will 5 barrels of flour cost if $\frac{5}{8}$ of a barrel cost $5.50?

6. What will 8 boxes of oranges cost if $\frac{3}{5}$ of a box cost $9?

7. $\frac{6}{7}$ of A's farm contains 216 acres; how many acres in the farm?

8. A miller bought 116 bushels of wheat at the rate of $1\frac{1}{3}$ bushels for 80 cents; what did it cost him?

9. A traveled 64 miles in $5\frac{1}{3}$ hours; how far at the same rate could he travel in 10 hours?

ORIGINAL PROBLEMS.

1. Measure the height and width of the doors in the schoolroom (expressed in feet), and find their surface.

2. Do the same with the windows and desks.

3. Find the average age of the pupils of the class.

4. Find the market-price of butter, and calculate the cost of $12\frac{1}{2}$ pounds, $18\frac{3}{4}$ pounds, etc., or how much can be bought for 2\frac{1}{2}$, 3\frac{1}{2}$, etc.

5. Do the same with eggs, lard, etc.

6. Find the price of land, and calculate the cost of $\frac{1}{2}$ of an acre, $\frac{3}{4}$ of an acre, etc.

7. How long will it take you to walk to the nearest town at the rate of $3\frac{1}{2}$ miles an hour?

GENERAL REVIEW.

EXAMPLES.

1. Find the value of $\frac{2}{3}$ of $\frac{5}{7}$ of $\frac{9}{20}$ of $\frac{14}{45}$.
2. Reduce 14 to a fraction having 22 for a denominator.
3. Add $4\frac{2}{3}$, $6\frac{3}{4}$, $9\frac{5}{6}$, and $11\frac{7}{12}$.
4. Subtract $\frac{32}{49}$ from $\frac{62}{63}$.
5. Reduce $\frac{42180}{18}$ to a mixed number.
6. Divide $45\frac{2}{3}$ by 12.
7. Multiply $62\frac{5}{8}$ by 24.
8. Find the value of $1\frac{1}{5} \times 2\frac{1}{3} \times 3\frac{4}{7} \times 4\frac{2}{3}$.
9. Reduce $\frac{5948}{6880}$ to its lowest terms.
10. Add $16\frac{3}{4}$, $7\frac{4}{5}$, $11\frac{3}{8}$, $9\frac{7}{20}$, and $8\frac{3}{10}$.
11. Reduce $233\frac{5}{17}$ to an improper fraction.
12. Find the value of $\frac{2}{3}$ of $\frac{3}{4} \times \frac{7}{9}$ of $\frac{15}{28} \times \frac{5}{12}$.
13. Find the value of 64 divided by $\frac{5}{7}$ of $\frac{14}{15}$.
14. Divide $18\frac{5}{8}$ by $32\frac{3}{8}$.
15. Multiply $71\frac{1}{4}$ by $11\frac{1}{5}$.
16. Reduce $\frac{29}{48}$ and $\frac{19}{64}$ to 576ths.
17. Which is the larger, $\frac{64}{96}$ or $\frac{648}{864}$?
18. Arrange in the order of magnitude $\frac{5}{6}$, $\frac{2}{3}$, and $\frac{3}{4}$.
19. Add $10\frac{2}{5}$, $16\frac{3}{10}$, $8\frac{8}{15}$, and $7\frac{7}{30}$.
20. Reduce $\frac{8640}{10368}$ to its lowest terms.
21. Find the value of $\frac{11}{12}$ of $\frac{5}{16}$ of $\frac{49}{77}$ of $\frac{14}{75}$.
22. Divide $8\frac{5}{9}$ by $25\frac{2}{3}$.
23. Multiply $81\frac{2}{3}$ by $15\frac{3}{7}$.
24. Reduce $\frac{5}{9}$ and $\frac{8}{15}$ to 315ths.
25. Add $8\frac{1}{2}$, $9\frac{2}{3}$, $10\frac{3}{4}$, and $12\frac{5}{8}$.
26. Reduce $10203\frac{7}{9}$ to an improper fraction.
27. Find the difference between $\frac{5}{8}$ of $\frac{54}{65}$ and $\frac{11}{13}$ of $\frac{75}{88}$.
28. Reduce 203 to a fraction having 81 as a denominator.
29. Find the value of $3\frac{1}{3} \times 2\frac{7}{10} \times 6\frac{2}{15} \times 2\frac{3}{46}$.
30. Find the value of $\frac{5}{8} - \frac{2}{5} + \frac{9}{4} - \frac{7}{6}$.
31. Divide $2\frac{7}{24}$ by $\frac{11}{40}$.
32. Add $16\frac{4}{5}$, $22\frac{3}{10}$, $15\frac{4}{25}$, and $18\frac{3}{5}$.

PRACTICAL PROBLEMS.

1. A school-room is $35\frac{3}{8}$ feet long and $24\frac{7}{8}$ feet wide; what is the distance around it?

2. B bought a farm containing $318\frac{3}{8}$ acres, and sold C $119\frac{5}{6}$ acres; how many acres had he remaining?

3. If $\frac{3}{8}$ of a bushel of potatoes cost 30 cents, what is the price per bushel?

4. If a man can do a piece of work in $3\frac{1}{8}$ days, working $8\frac{1}{3}$ hours a day, how long will it take him working $9\frac{3}{8}$ hours a day?

5. If A travels $4\frac{1}{2}$ miles an hour and $8\frac{3}{4}$ hours a day, how many days will it take him to travel $494\frac{3}{8}$ miles?

6. A man bought a carriage for $\$212\frac{3}{4}$, a horse for $\$196\frac{7}{8}$, and a set of harness for $\$15\frac{2}{5}$: he paid for them with a check for $500; how much change did he receive?

7. A farmer has 800 bushels of grain consisting of wheat, corn, and rye; how much rye has he, if he has $315\frac{7}{8}$ bushels of wheat and $304\frac{5}{9}$ bushels of corn?

8. The sides of a field are $42\frac{2}{3}$ rods, $28\frac{1}{4}$ rods, $19\frac{5}{6}$ rods, $31\frac{1}{7}$ rods, and $26\frac{5}{21}$ rods; what is the distance around it?

9. A merchant bought 48 bushels of wheat at $55\frac{1}{2}$ cents a bushel, and sold $\frac{1}{2}$ of it at $60\frac{3}{4}$ cents a bushel, $\frac{1}{3}$ of it at 59 cents, and the remainder at $61\frac{7}{8}$ cents; what was his entire gain?

10. The sum of two fractions is $\frac{41}{55}$, and one of the fractions is $\frac{5}{22}$; what is the other?

11. There are 1760 yards in a mile; how many yards in $\frac{5}{7}$ of a mile?

12. There are $24\frac{3}{4}$ cubic feet in a perch; how many perches in 400 cubic feet?

13. Two men start from the same place and walk in opposite directions, one at the rate of $3\frac{1}{3}$ miles an hour, and the other $4\frac{1}{2}$ miles an hour; how far apart will they be in 1 hour? In $8\frac{1}{2}$ hours?

14. A merchant bought three cans of lard, weighing respectively $51\frac{1}{2}$ lbs., $49\frac{3}{4}$ lbs., and $52\frac{5}{8}$ lbs.: the weight of the empty cans was $2\frac{1}{3}$ lbs. each; what was the weight of the lard? What did it cost at $12\frac{1}{2}$ cents a pound?

15. A sold $\frac{5}{7}$ of his farm for $8472; at this rate, what was the value of the entire farm?

16. Mr. Miller had two farms: the income from the first was $1842½, which was $\frac{5}{8}$ of the income from the second; what was the income from both farms?

17. How many pounds of sugar at $6\frac{1}{2}$ cents a pound can be bought with $18\frac{3}{4}$ pounds of butter at 20 cents a pound?

18. Mr. Lansinger traveled on his bicycle $30\frac{1}{2}$ miles on Monday, $40\frac{2}{3}$ miles on Tuesday, $35\frac{5}{6}$ miles on Wednesday, $50\frac{3}{8}$ miles on Thursday, $60\frac{5}{12}$ miles on Friday, and $51\frac{3}{4}$ miles on Saturday; what was the average rate per day?

19. If $\frac{7}{8}$ of a ton of hay is worth $16⅓, how much are 8 tons worth at the same rate?

20. I sold my house and lot for $3264, which was $\frac{16}{19}$ of what they cost me; how much did I lose by the transaction?

21. The circumference of the fore wheel of a wagon is $7\frac{1}{3}$ feet, and of the hind wheel $8\frac{1}{4}$ feet; how many revolutions does each wheel make in going a mile (5280 feet)?

22. If 10 tons of coal cost $52½, what will $16\frac{1}{2}$ tons cost at the same rate?

23. What will $\frac{15}{16}$ of an acre of land cost at the rate of $4\frac{1}{5}$ acres for $177 6/25?

24. A lot is $24\frac{1}{3}$ rods long, which is $\frac{3}{2}$ of its width; what is the distance around the lot?

25. The sum of two mixed numbers is $402\frac{1}{6}$, and one of them is $107\frac{3}{4}$; what is the other?

26. The sum of three mixed numbers is $218\frac{1}{3}$; the first is $45\frac{1}{2}$ and the second is $114\frac{3}{4}$; what is the third?

27. If $\frac{5}{8}$ of a ton of coal cost $5¼, what will one ton cost at the same rate?

28. At $\$\frac{4}{5}$ a basket, how many baskets of peaches can be bought for $\$12\frac{4}{5}$?

29. Multiply one hundred and seventy-five and two-thirds by thirty-six.

30. Which is the larger, and how much, $\frac{3}{4}$ of 71 or $\frac{5}{8}$ of 82?

31. From forty million one hundred and sixteen thousand take three-fourths of two hundred and four thousand nine hundred and thirty-six.

32. What do I receive per pound by selling $33\frac{1}{3}$ pounds of butter for $\$13\frac{1}{3}$?

33. A lost $\frac{2}{5}$ of his money and had $411 remaining; how much had he at first?

34. B lost $\frac{4}{5}$ of his money, which was $612; how much had he at first?

35. C traveled 100 miles: the first half of the journey he walked at the rate of $4\frac{1}{6}$ miles an hour, and the last half at the rate of $5\frac{5}{6}$ miles an hour; how many hours did it take him to walk the entire distance?

36. What will 40 yards of muslin cost at the rate of $8\frac{1}{3}$ cents a yard?

37. I paid $\$41\frac{1}{4}$ for eleven hats, and sold them at $5 apiece; how much did I gain on each hat?

38. A farmer bought $318\frac{2}{3}$ acres of land, and sold A $110\frac{5}{6}$ acres and B $90\frac{3}{4}$ acres; how many acres had he remaining?

39. Mr. White bought of Mr. Bowman

12 pounds of sugar at $5\frac{1}{2}$ cts. a pound;
20 pounds of butter at $18\frac{1}{2}$ cts. a pound;
36 yards of muslin at $7\frac{1}{2}$ cts. a yard;
18 yards of cloth at $\$1\frac{1}{2}$ a yard;
8 barrels of flour at $\$4\frac{1}{2}$ a barrel.

What was the amount of the bill?

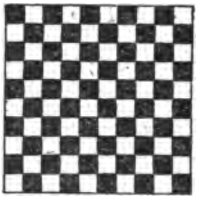
40. Write a proper fraction.

41. Write an improper fraction.

42. Write a mixed number.

SECTION IV.

DECIMAL FRACTIONS.



A Square Inch.

63.—*1.* If a square inch is divided into ten equal parts, what is one of these parts called?

2. If one-tenth of a square inch is divided into ten equal parts, what is one of these parts called?

3. What is $\frac{1}{10}$ of $\frac{1}{10}$? How many hundredths in one-tenth?

4. If one-hundredth of a square inch is divided into ten equal parts, what is one of these parts called?

5. What is $\frac{1}{10}$ of $\frac{1}{100}$? How many thousandths in one-hundredth?

6. If one-thousandth of a square inch is divided into ten equal parts, what is one of these parts called?

7. What is $\frac{1}{10}$ of $\frac{1}{1000}$? How many ten-thousandths in one-thousandth?

64. A fraction whose denominator is 10, 100, 1000, 10000, etc., as $\frac{3}{10}$, $\frac{3}{100}$, $\frac{3}{1000}$, $\frac{3}{10000}$, etc., is called a **Decimal Fraction.**

A *decimal fraction* is usually expressed by placing a period, called the *decimal point* (**.**), before the numerator, and omitting the denominator.

Thus, $\frac{3}{10}$ is expressed, .3; $\frac{3}{100}$ is expressed, .03; $\frac{3}{1000}$ is expressed, .003; $\frac{3}{10000}$ is expressed, .0003, etc.

65. The following table shows that decimals are only a continuation of the *common system* of notation, and that the value of a decimal figure depends upon its position.

1000.	One thousand.
100.	One hundred.
10.	One ten.
1.	One.
.1	One-tenth.
.01	One-hundredth.
.001	One-thousandth.
.0001	One ten-thousandth.

The first place to the right of the decimal point is *tenths,* the second place is *hundredths,* the third is *thousandths,* the fourth is *ten-thousandths,* etc.

NUMERATION AND NOTATION.

66. The following suggestion will aid the pupil in reading decimals:

Read the decimal as a whole number, and give it the denomination of the last figure.

Thus, .36 is read 36 hundredths.

Read—

1. .5.
2. .8.
3. .9.
4. .25.
5. *.86.*
6. .75.
7. .125.
8. .425.
9. .625.
10. .1235.
11. 2.5.
12. 3.25.
13. 25.25.
14. 1.05.
15. .005.
16. 28.005.
17. 405.05.
18. 6.25.
19. 8.008.
20. 10.01.
21. 14.0014.
22. .505.
23. .0706.
24. 1.001.
25. .1001.
26. .0001.
27. 10.01.

Express decimally—

28. $\frac{8}{10}$.
29. $\frac{7}{10}$.
30. $\frac{9}{10}$.
31. $\frac{25}{100}$.
32. $\frac{46}{100}$.
33. $\frac{8}{100}$.
34. $\frac{125}{1000}$.
35. $\frac{326}{1000}$.
36. $\frac{26}{1000}$.
37. $\frac{6}{1000}$.
38. $\frac{1235}{10000}$.
39. $\frac{2345}{10000}$.
40. $8\frac{345}{10000}$.
41. $9\frac{45}{10000}$.
42. $6\frac{5}{1000}$.
43. $\frac{1001}{100}$.
44. $\frac{252}{10}$.
45. $\frac{1475}{100}$.

46. Write 25 thousandths decimally.

We write 25 as a whole number, and place the decimal point so as to express thousandths; thus, .025.

Express decimally—

47. Thirty-five hundredths.
48. Seventy-five hundredths.
49. Ninety-three hundredths.
50. One hundred and twenty-five thousandths.
51. Five hundred and six thousandths.
52. Ninety-two hundred-thousandths.
53. Five thousandths.
54. 416 thousandths.
55. 85 ten-thousandths.
56. 315 ten-thousandths.
57. 151432 millionths.
58. 51432 millionths.
59. 78 hundredths.
60. 216 ten-thousandths.
61. 6 thousandths.
62. 1432 ten-millionths.
63. 101 thousandths.

REDUCTION OF DECIMALS.

CASE I.

67. To reduce a decimal to a common fraction.

1. Reduce .65 to a common fraction.

PROCESS.—.65 = $\frac{65}{100}$ = $\frac{13}{20}$.

By omitting the decimal point and supplying the denominator, .65 equals $\frac{65}{100}$, which by reduction is $\frac{13}{20}$.

Hence, to reduce a decimal to a common fraction, *omit the decimal point, supply the denominator, and reduce the fraction to its lowest terms.*

Reduce to common fractions—

2. .6.
3. .25.
4. .45.
5. .75.
6. .125.
7. .625.
8. 9.25.
9. 10.75.
10. .075.
11. .0625.
12. 4.025.
13. 28.25.
14. .1875.
15. .0875.
16. .00125.
17. .0075.
18. 4.0025.
19. .4375.

CASE II.

68. To reduce a common fraction to a decimal.

1. Reduce $\frac{3}{4}$ to a decimal.

PROCESS.
4)3.00
.75

By ART. 45, $\frac{3}{4}$ equals 3 divided by 4. 3 is equal to 30 tenths. 4 is contained in 30 tenths 7 tenths times, with 2 tenths or 20 hundredths remaining; 4 is contained in 20 hundredths 5 hundredths times. Therefore $\frac{3}{4}$ equals .75.

Hence, to reduce a common fraction to a decimal, *annex ciphers to the numerator and divide by the denominator, pointing off as many decimal places as there are ciphers annexed.*

Reduce the following fractions to decimals:

2. $\frac{1}{5}$.
3. $\frac{1}{2}$.
4. $\frac{1}{4}$.
5. $\frac{1}{8}$.
6. $\frac{5}{8}$.
7. $\frac{7}{8}$.
8. $\frac{1}{16}$.
9. $\frac{5}{16}$.
10. $\frac{3}{5}$.
11. $2\frac{11}{16}$.
12. $6\frac{1}{4}$.
13. $25\frac{1}{2}$.
14. $\frac{7}{16}$.
15. $8\frac{3}{8}$.
16. $2\frac{7}{40}$.
17. $9\frac{12}{25}$.
18. $72\frac{13}{80}$.
19. $12\frac{2}{125}$.

69. The processes of adding, subtracting, multiplying, and dividing decimals are the same as in whole numbers.

ADDITION OF DECIMALS.

70.—*1.* What is the sum of 18.25, 25.42, 40.28, and 65.47?

PROCESS.

```
 18.25
 25.42
 40.28
 65.47
------
149.42
```

Write the numbers, keeping the decimal point in the same vertical column. Add as in whole numbers.

Add the following:

2. 34.56, 78.25, 16.75, and 14.35.
3. 6.532, 6.457, 3.754, and 6.372.
4. 4.321, 6.543, 4.161, and .303.
5. 8.632, 16.78, 675.4, 6.850, and 97.62.
6. 8.8, .0007, 25.4216, 4.53, and 162.0708.
7. 47.202, 11.03, 4.728, 783.5, and .6432.
8. 2.34, 45.234, 6.2345, 8.4567, and 9.4321.
9. 2.5, 12.25, 324.165, 3214.8216, and 12345.54321.
10. 4.03, 1216, 3045, 27.1, and 345.2.
11. 123.475, 25.52, 4.8, and 300.003.
12. 400.004, .404, 200.02, and 20.02.

SUBTRACTION OF DECIMALS.

71.—*1.* From 86.25 take 21.78.

PROCESS.

```
86.25
21.78
-----
64.47
```

Write the numbers, keeping the decimal point in the same vertical column. Subtract as in whole numbers.

Subtract the following:

2. 48.65 from 125.32.
3. 125.325 from 300.629.
4. 62.3456 from 100.42.
5. 471.3465 from 862.75.
6. 48.0007 from 316.7.
7. 2.86543 from 11.11.
8. .08065 from 12.
9. 3.48546 from 25.
10. .00091 from 1.
11. .999999 from 1.

MULTIPLICATION OF DECIMALS.

72.—*1.* Multiply .25 by 2.5.

Process.

```
 .25
 2.5
----
 125
 50
----
.625
```

Multiplying as in whole numbers, we have 625.

Since hundredths multiplied by tenths give thousandths ($\frac{25}{100} \times \frac{25}{10} = \frac{625}{1000}$), the product of .25 by 2.5 is 625 thousandths, or .625, and *contains as many decimal figures as there are in both factors.*

Hence, to multiply decimals, *multiply as in whole numbers, and point off in the product as many decimal figures as both factors contain.*

If the product does not contain as many figures as required, prefix ciphers.

2. Multiply 12.18 by .2.
3. Multiply 3.16 by .3.
4. Multiply 4.132 by .04.
5. Multiply 1.26 by .22.
6. Multiply 3.27 by .64.
7. Multiply 1.23 by .212.
8. Multiply .6132 by .23.
9. Multiply 1.234 by .007.
10. Multiply 12.3 by .0006.
11. Multiply 11.36 by .008.
12. Multiply .024 by .016.
13. Multiply 2.03 by .123.

14. Multiply .26 by 2.13 by .34.

15. Multiply 2.5 by .25 by .025.

16. Multiply .6254 in succession by 1; 10; 100; 1000; 10000.

.6254 × 1 = .6254
.6254 × 10 = 6.254
.6254 × 100 = 62.54
.6254 × 1000 = 625.4
.6254 × 10000 = 6254.

From this example we see that multiplying a decimal by 10, 100, 1000, etc.,

Removes the decimal point as many places to the right as there are ciphers in the multiplier.

17. Multiply 6.7854 by 10; by 100; by 1000; by 10000.

18. Multiply .3141 by 10; by 100; by 1000; by 10000.

DIVISION OF DECIMALS.

73.—*1.* Divide .625 by .25.

PROCESS.
.25).625(2.5
50
125
125

Dividing as in whole numbers, we have 25. Since thousandths divided by hundredths is tenths ($\frac{625}{1000} \div \frac{25}{100} = \frac{625}{1000} \times \frac{100}{25} = \frac{25}{10}$, or 2.5), the quotient of .625 divided by .25 is 25 tenths, or 2.5, *and contains as many decimal places as the number of decimal places in the dividend exceeds the number of decimal places in the divisor.*

Hence, to divide decimals, *divide as in whole numbers, and point off in the quotient as many decimal places as the number of decimal places in the dividend exceeds the number of decimal places in the divisor.*

2. Divide .25 by .5.
3. Divide .625 by .5.
4. Divide .512 by .08.
5. Divide 3.1416 by 4.
6. Divide .315 by .21.
7. Divide 17.28 by .12.
8. Divide 10.92 by .26.
9. Divide .5628 by .0042.

When the number of decimal places in the dividend is less than the number of decimal places in the divisor, annex ciphers to make them equal.

10. Divide 192.2 by .31.
11. Divide 95.04 by .022.
12. Divide 64 by .04.
13. Divide 25 by .005.
14. Divide 81 by .0009.
15. Divide .3125 by 12.5.
16. Divide 48 by .0048.
17. Divide 625 by .0625.

When the number of figures in the quotient is less than the difference between the number of decimal places in the dividend and the number of decimal places in the divisor, prefix ciphers.

18. Divide .3348 by 124.
19. Divide .00688 by 1.6.
20. Divide .0175 by .5.
21. Divide 1522.8 by .36.
22. Divide 5.80215 by .047.
23. Divide 49.2 by 12.

24. Divide 6254 by 10; 100; 1000; 10000.

6254 ÷ 1 = 6254.
6254 ÷ 10 = 625.4
6254 ÷ 100 = 62.54
6254 ÷ 1000 = 6.254
6254 ÷ 10000 = .6254

From this problem we see that dividing by 10, 100, 1000, 10,000, etc.,

Removes the decimal point as many places to the left as there are ciphers in the divisor.

25. Divide 6875.4 by 10; by 100; by 1000.

26. Divide .3 by 10; by 100; by 1000.

PRACTICAL PROBLEMS.

1. What will 21.35 pounds of butter cost at 32.5 cents a pound?

2. When hay is worth $16.25 a ton, what will 14.75 tons cost?

3. What will 167.5 acres of land cost at $82.125 an acre?

4. What will 17.5 gallons of oil cost at $3.875 a gallon?

5. Divide $388.325 by 12.25.

6. What will a barrel of sugar cost that weighs 276 pounds, at $.05⅞ a pound?

7. A merchant has a tank containing 1480.5 gallons of vinegar; how many barrels, each containing 31.5 gallons, can be filled from the tank?

8. What is the cost of 18 tons of iron, if the cost of 1 ton is $14.83?

9. There are 25.8 grains in a gold dollar; how many dollars can be made from 2580 grains?

10. A gallon of distilled water weighs 8.3388 pounds; how many gallons in 102.56724 pounds?

11. There are 31.5 gallons in a barrel; how many gallons in 32.25 barrels?

12. How many cubic feet in 21.5 perches of stone, if one perch contains 24.75 cubic feet?

13. If one bushel contains 2150.42 cubic inches, how many bushels in 26880.25 cubic inches?

14. If 1 pound sterling is worth $4.8665, what is the value of 21 pounds?

15. If a mark, German money, is worth 23.85 cents, how many dollars in 10,000 marks?

16. How many marks in $477?

17. If a franc, French money, is worth 19.3 cents, how many dollars in 12,000 francs?

18. How many francs in $23.16?

19. The product of two numbers is 29.21, and one of the numbers is 12.7; what is the other?

20. If a vessel sails 13.25 miles per hour, in how many hours will it sail 278.25 miles?

21. What number multiplied by 2.36 will give a product of 101.6688?

22. Divide sixty-five thousandths by twenty-six thousandths.

23. Divide eight ten-thousandths by four hundred.

24. Divide fifteen hundred by five ten-thousandths.

25. M bought 1215 bushels of wheat at $.51 a bushel, and sold it at $.57 a bushel; required the gain.

26. What is the gain on 1000 gallons of coal oil bought at $.05$\frac{1}{4}$ a gallon and sold at $.15 a gallon?

27. A farmer bought land at $128.37 an acre and sold it at $130 an acre; how many acres did he buy if he gained $676.45?

28. A drover bought a number of horses at $225.25 a head, paid $3.875 apiece for transportation, and sold them for $240 a head; how many did he buy if he gained $228.375?

29. A train of cars has 275 miles to run; how many hours will it require for the trip at the average rate of 27.5 miles an hour?

GENERAL REVIEW.

1. Read .08, .005, 4.0006, .000001, 600.006, and .606.

2. Express decimally $\frac{425}{10}$, $\frac{42}{100}$, $\frac{1487}{100}$, $\frac{7568}{1000}$, $\frac{14832}{100}$, and $\frac{1}{100000}$.

3. Reduce .00025 to a common fraction.

4. Reduce $2\frac{13}{16}$ to a decimal.

5. Add .008, 412.2, 800.1, .00031, 100.001, and 9.87.

6. Subtract .0087432 from 87432.

7. Multiply 8.36 by .00025.

8. Divide 160 by .004.

9. Express $\frac{4}{100}$, $\frac{2}{10000}$, $\frac{42}{100}$, $\frac{90210}{1000}$, and $\frac{1}{1000000}$ decimally.

10. Reduce .96875 as a common fraction, and reduce it to its lowest terms.

11. Reduce $\frac{3}{40}$ and $\frac{5}{16}$ to decimals and find their sum.

12. Reduce $\frac{3}{8}$ and $\frac{4}{25}$ to decimals and find their difference.

13. Add 400.5, .0006, 62.5, .908, 41.286321, and 17.0006.

14. Subtract .00006215 from .0086714.

15. Multiply 86.41325 by 10000.

16. Divide 38621.65 by .00001.

17. Reduce $\frac{7}{128}$ to a decimal.

18. How many dollars in 18000 cents?

19. How many cents in 416 dollars?

20. Multiply $\frac{2}{5}$ of $\frac{15}{16}$ by .0024.

21. Divide .0016 by $\frac{2}{5}$ of 200.

22. Add $8\frac{1}{3}$, $16\frac{2}{5}$, $14\frac{5}{8}$, $10\frac{1}{12}$, and $7\frac{1}{2}$.

23. Add 8.5, 14.15, 122.315, 6141.8615, and .0002.

24. Reduce .0625 to a common fraction in its lowest terms.

25. What is the product of $6 \times \frac{2}{3} \times 8\frac{1}{2}$ by $7 \times 40\frac{1}{2} \times 9\frac{1}{3} \times 6$?

26. What number must be multiplied by $8\frac{1}{3} \times 7\frac{1}{2}$ that the product may be 100?

27. A man labored 15 days for $3.25 a day; how much did he earn?

28. A merchant sold five loads of coal weighing respectively 2.25 tons, 1.875 tons, 2.375 tons, 3.1 tons, and 2.625 tons; how many tons in the five loads?

29. A owes the following sums: for coal, $50.62; for repairing his house, $162.75; for lumber, $187.09; for brick and stone, $37.18; for hardware, $67.12; and for other expenses, $214.04; how much does he owe?

30. A widow received one-third of an estate of $1222.50, and the remainder was divided equally among 10 children; what did each child receive?

31. The annual expenses of a man's family are as follows: for clothing, $250.75; for fuel, $50.50; for provisions, $400.25; for house-rent, $200; for books, papers, etc., $35.15; for services of physician, $25.50; and for all other expenses, $150.60; how much can he save annually out of a salary of $1400?

32. Mr. Noble's property amounted to $34625.80 at his death: he owed A $407.08, B $204.25, and C $500.50; how much was left after paying the debts?

33. A lady went shopping with $20 in her purse; she paid 45 cents for a basket, $1.12 for a hat, $7.375 for cloth, and bought 15 yards of ribbon at $.32 a yard; how much had she remaining?

34. A farmer sold his butter at 18 cents a pound and received $6.48; how many pounds did he sell?

35. Find the value of the following expressions: $(.725 \div .0025)$. $(.0012 \times .06)$. $(42.1 - .00082)$. $(.0002 \div 500)$.

36. Divide 28.614 by 100, 421.2 by 1000, 8632.1 by 10000, 99800.2 by 100000, and add the quotients.

37. A ton of iron ore from the mines of Western Pennsylvania yields .71 of a ton of pure iron; how much iron will 816.4 tons of ore yield?

38. What will 8624 bricks cost at $9.25 a thousand?

39. What will 7216 feet of lumber cost at $35 a thousand?

SECTION V.

DENOMINATE NUMBERS.

In the business affairs of life it is necessary, in buying and selling articles, to estimate their value in *dollars* and *cents*, and to measure the quantity—

Sometimes in *tons*, *pounds*, and *ounces*,
Sometimes in *gallons*, *quarts*, and *pints*,
Sometimes in *bushels*, *pecks*, and *quarts*,
Sometimes in *yards*, *feet*, and *inches*,
Sometimes in *acres*, *square rods*, and *square yards*,
Sometimes in *cubic yards*, *cubic feet*, and *cubic inches*, etc.

These measures, with others that have reference to *time*, to *circles*, and to various *miscellaneous objects*, are expressed in **Denominate Numbers.**

UNITED STATES MONEY.

74. United States Money is the legal currency of the United States.

TABLE.

10 cents (cts.) = 1 dime, d.
10 dimes = 1 dollar, $.

$1 = 10 d. = 100 cts.

United States money consists of *coin* and *paper money.*

The *coins* of the United States are as follows:

Gold, the *quarter-eagle* ($2½), *half-eagle* ($5), *eagle* ($10), and *double-eagle* ($20).

Silver, the *dime, quarter-dollar, half-dollar,* and *dollar.*

Nickel, the *five-cent piece.*

Bronze, the *cent.*

NOTE.—1. By an act of Congress approved September 26, 1890, the coinage of gold dollars, gold three-dollar pieces, and nickel three-cent pieces was suspended.

2. For the numeration and notation of United States money, see ART. 7.

ORAL EXERCISES.

1. How many cents in 1 dime? 4 dimes? 8 dimes? 10 dimes? 12 dimes? 15 dimes? 20 dimes? 30 dimes?

2. How many dimes in 30 cents? 50 cents? 80 cents? 100 cents? 120 cents? 150 cents? 200 cents? 250 cents?

3. How many cents in 1 dollar? 3 dollars? 4 dollars? 6 dollars? 12 dollars? 15 dollars? 20 dollars? 25 dollars?

4. How many dollars in 200 cents? 500 cents? 700 cents? 1000 cents? 1400 cents? 2000 cents? 2500 cents?

5. How many dimes in 1 dollar? 5 dollars? 8 dollars? 10 dollars? 15 dollars? 20 dollars? 30 dollars?

6. How many dollars in 10 dimes? 50 dimes? 80 dimes? 120 dimes? 200 dimes? 250 dimes? 300 dimes?

THE MONEY OF OTHER COUNTRIES.

English Money is the legal currency of England.

The *unit* is the *pound*, which when coined is called the sovereign, whose value is $4.8665.

The other denominations and the table are: 4 farthings = 1 penny, 12 pence = 1 shilling, 20 shillings = 1 pound, 21 shillings = 1 guinea.

French Money is the legal currency of France.

The *unit* is the *franc*, whose value is 19.3 cents.

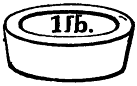
German Money is the legal currency of Germany.

The *unit* is the *mark*, whose value is 23.85 cents.

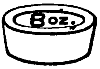
AVOIRDUPOIS WEIGHT.

75. Avoirdupois Weight is used in weighing all common articles.

Light articles are weighed by the *pound*, and heavy articles by the *ton*.



Pound.



Half-pound.

Quarter-pound.

2 Ounces.

1 Ounce.

TABLE.

16 ounces (oz.) = 1 pound, lb.
2000 pounds = 1 ton, T.

Many articles are sold by weight, as follows:

1 bu. of wheat = 60 lb.
1 bu. of corn = 56 lb.
1 bu. of oats = 32 lb.
1 bu. of barley = 48 lb.
1 bu. of potatoes = 60 lb.
1 barrel of flour = 196 lb.
1 barrel of pork = 200 lb.
1 keg of nails = 100 lb.

Note.—The weight of some of these articles differs slightly in different States, but the weights here given are generally adopted.

ORAL EXERCISES.

1. How many ounces in 1 lb.? In ½ lb.? In ¼ lb.?

2. How many ounces in 2 lb.? In 3 lb.? In 4 lb.?

3. How many ounces in 3½ lb.? In 4 lb. 4 oz.?

4. How many pounds in 48 oz.? In 64 oz.?

5. How many pounds in 2 tons? In 3 tons?

6. How many tons in 6000 lb.? In 8000 lb.?

7. If a pound of tea costs 80 cents, what will ¼ of a pound cost? ½ of a pound? 2 oz.? 1 oz.?

8. If a pound of cheese costs 16 cents, what will 2 lb. 4 oz. cost? 3 lb. 8 oz.? 2 lb. 2 oz.?

9. If a pound of coffee costs 32 cents, what will 4½ pounds cost? 22 oz.? 3 lb. 2 oz.?

10. At 2½ cents an ounce, what will 1 lb. of cinnamon cost? 2 lb.? 2½ lb.?

WRITTEN EXERCISES.

11. What will it cost to ship 5 T. 476 lb. of freight at ½ cent a pound?

12. What will a barrel of flour cost at 3 cents a pound?

13. What will 6 barrels of pork cost at 11 cents a pound?

14. What will 5.25 tons of hay cost at $12.25 a ton?

15. How many cannon-balls, each weighing 20 lb. 13⅛ oz., can be made out of a ton of iron?

16. At 8½ cents a pound, how much rice can be bought for $425?

17. What will 18 kegs of nails cost at 3½ cents a pound?

18. What will 25 lb. 8 oz. of drugs cost at 54 cents an ounce?

19. How many rings, each weighing ¼ oz., can be made from 1 T. 65 lb. 10 oz. of iron, allowing 2 lb. for waste?

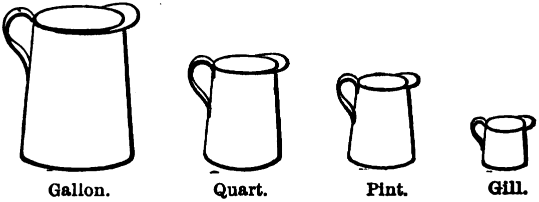
20. At 3¼ cents a pound, how many barrels of flour can be bought for $127.40?

21. What will 1350 pounds of iron cost at $16 a ton?

22. A farmer sold 7375 pounds of hay at $14 a ton; what did he receive for it?

23. A coal-dealer charged $13.31 for 4840 pounds of coal; what was the price per ton?

LIQUID MEASURE.



76.

TABLE.

4 gills (gi.) = 1 pint, pt.
2 pints = 1 quart, qt.
4 quarts = 1 gallon, gal.

1 gal. = 4 qt. = 8 pt. = 32 gi.

The size of casks is variable. A barrel generally holds 31½ gallons, and a hogshead 63 gallons.

A gallon contains 231 cubic inches.

ORAL EXERCISES.

1. How many gills in 2 pints? In 4 pints? In 6 pints? In 8 pints? In 9 pints?

2. How many pints in 12 gills? In 20 gills? In 24 gills? In 32 gills? In 40 gills?

3. How many pints in 3 qt.? In 6 qt.? In 10 qt.? In 16 qt.? In 20 qt.?

4. How many quarts in 10 pt.? In 16 pt.? In 24 pt.? In 32 pt.? In 40 pt.?

5. How many quarts in 5 gal.? In 7 gal.? In 8 gal.? In 7½ gal.? In 9 gal.?

6. How many gallons in 16 qt.? In 20 qt.? In 22 qt.?

7. How many quarts in 13 pt.? In 17 pt.? In 4 gal.?

8. How many quarts in 6¾ gal.? In 9½ gal.? In 10¼ gal.?

9. At 3 cents a quart, what will 2 gallons of vinegar cost?

WRITTEN EXERCISES.

10. Reduce 128 gills to gallons.

11. Reduce 10 gallons to quarts. To pints. To gills.

12. Reduce 5 gal. 4 qt. to quarts.

13. Reduce 10 gal. 3 qt. 1 pt. 3 gi. to gills.

PROCESS.

gal. qt. pt. gi.
10 3 1 3
4
43 qt.
2
87 pt.
4
351 gi., *Ans.*

10 gal. = 10 times 4 qt. = 40 qt., and 40 qt. + 3 qt. = 43 qt.

43 qt. = 43 times 2 pt. = 86 pt., and 86 pt. + 1 pt. = 87 pt.

87 pt. = 87 times 4 gi. = 348 gi., and 348 gi. + 3 gi. = 351 gi.

14. Reduce 12 gal. 2 qt. 1 pt. to pints.

15. Reduce 15 gal. 1 pt. to pints.

16. Reduce 20 gal. 3 qt. 1 pt. 3 gi. to gills.

17. Reduce 127 gi. to gallons.

PROCESS.

4)127 gi.
2)31 pt. + 3 gi.
4)15 qt. + 1 pt.
3 gal. + 3 qt.
Ans., 3 gal. 3 qt. 1 pt. 3 gi.

There are 4 gills in one pint, hence in 127 gills there are 31 pt. and 3 gi. remaining.

There are 2 pints in one quart, hence in 31 pints there are 15 qt. and 1 pt. remaining.

There are 4 quarts in one gallon, hence in 15 quarts there are 3 gal. and 3 qt. remaining.

18. Reduce 124 pt. to gallons.

19. Reduce 502 gills to gallons.

20. What will 6 gal. 3 qt. 1 pt. of vinegar cost at 3 cents a pint?

21. How many cubic inches in 8 gal.? In 10 gal.?

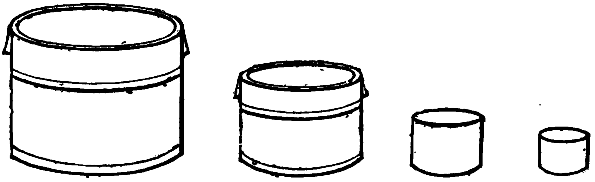
22. How many gallons will a vessel hold that contains 3003 cubic inches?

23. A bought a barrel of coal oil that contained 52 gal. at 5¼ cents a gallon, and sold it at 15 cents a gallon; what was his gain?

24. A grocer bought a hogshead of molasses that contained 98 gallons at 34 cents a gallon, and sold it at 12 cents a quart; what was his gain?

25. A druggist put up 20 gallons of perfumery in bottles holding 2 gills each; how many bottles did it require?

DRY MEASURE.



Half-bushel. **Peck.** **Quart.** **Pint.**

77.

TABLE.

2 pints (pt.) = 1 quart, qt.
8 quarts = 1 peck, pk.
4 pecks = 1 bushel, bu.

1 bu. = 4 pk. = 32 qt. = 64 pt.

A bushel contains 2150.42 cu. in.

ORAL EXERCISES.

1. How many quarts in 4 pk.? In 6 pk.? In 9 pk.? In 10 pk.?

2. How many pecks in 32 qt.? In 56 qt.? In 80 qt.? In 96 qt.?

3. How many pecks in 7 bu.? In 8 bu.? In 10 bu.? In 20 bu.?

4. How many bushels in 32 pk.? In 48 pk.? In 72 pk.? In 100 pk.?

5. What part of a bushel is 1 peck? 2 pecks? 3 pecks? 10 pecks?

6. What part of a peck is 1 qt.? 2 qt.? 3 qt.? 4 qt.? 6 qt.?

7. What part of a bushel is 1 peck? 1 qt.? 1 pt.?

8. What is the price of apples per bushel when they are selling at 15 cents a half-peck?

9. What is the price of sweet potatoes per bushel when they are selling at 8 cents a quarter of a peck?

WRITTEN EXERCISES.

10. A man sold 1 bu. 3 pk. of clover-seed at 80 cents a peck; what did he receive for it?

11. How many bushels of chestnuts can be bought for $12.80 at 10 cents a quart?

12. A fruit-dealer bought apples at 40 cents a bushel and sold them at 18 cents a peck, and thereby gained $5.44; how many bushels did he sell?

13. What will 10 bu. 3 pk. 6 qt. of seed cost at 12 cents a quart?

14. How many bu., pk., and qt. in 157 qt.?

15. How many cubic inches in 10 bu.?

16. James bought 6 bushels of chestnuts at $2.75 a bushel, and sold them at 12 cents a quart; what was his gain?

MEASURES OF TIME.

78. Time is measured by the following

TABLE.

60 seconds (sec.)	=	1 minute,	min.
60 minutes	=	1 hour,	hr.
24 hours	=	1 day,	da.
7 days	=	1 week,	wk.
365 days	=	1 common year,	yr.
366 days	=	1 leap year,	l. yr.
100 years	=	1 century,	C.

Every year divisible by 4 except the centennial years, and every centennial year divisible by 400, is a *leap year*.

The *Calendar* months are as follows:

January,	31 days,	Jan.	July,	31 days,	July.
February,	28 or 29 days,	Feb.	August,	31 days,	Aug.
March,	31 days,	Mar.	September,	30 days,	Sept.
April,	30 days,	Apr.	October,	31 days,	Oct.
May,	31 days,	May.	November,	30 days,	Nov.
June,	30 days,	June.	December,	31 days,	Dec.

ORAL EXERCISES.

1. How many seconds in 10 min.? In 30 min.?

2. How many minutes in 2 hr.? In 720 sec.?

3. How many hours in 4 days? In 960 min.?

4. How many days in 5 weeks? In 144 hr.?

5. How many days in 2 common years? In 2 leap years?

6. Which of the following years are leap years: 1600? 1894? 1800? 1880? 1896? 1900? 2000? Why?

7. When does this century end?

8. How many leap years in a century?

9 Name the months which have 30 days each. Those which have 31 days.

WRITTEN EXERCISES.

10. How many minutes from 10 A. M., May 30th, to 6 P. M., June 1st?

11. How many seconds in a common year?

12. If your pulse beats 72 times a minute, how many times will it beat in the month of February, 1896?

13. How many days from July 4th to December 25th?

MISCELLANEOUS TABLES.

79.

NUMBERS.

12 units = 1 dozen.
12 dozen = 1 gross.
20 units = 1 score.

PAPER.

24 sheets = 1 quire.
20 quires = 1 ream.
480 sheets = 1 ream.

ORAL EXERCISES.

1. How many eggs in 6 dozen? 10 dozen?

2. How many dozen in 3 gross?

3. How many years in 3 score and 10 years?

4. How many sheets of paper in 4 quires? 5½ quires?

5. How many sheets of paper in 1 ream?

6. How many dozen in 132 units? 156?

7. How many score in 90? 100? 130?

8. How many quires in 72 sheets of paper?

WRITTEN EXERCISES.

9. Reduce 10 quires and 19 sheets to sheets.

10. Reduce 2500 sheets to quires.

11. What will 120 gross of screws cost at 3 cents a dozen?

12. What will 30 gross of buttons cost at 2 cents apiece?

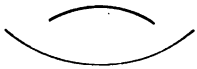
13. A news-dealer bought 100 reams of paper at $2.50 a ream, and sold it at 18 cents a quire; how much did he gain?

LONG MEASURE.

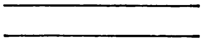
80. **Long Measure** is used in measuring lines or distances.

A **Line** is that which has length only.

Straight Line.



Curved Lines.



Parallel Lines.

1. Draw a straight line. A curved line. Parallel lines.

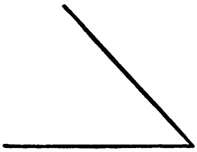
2. How often does a straight line change its direction?

3. How often does a curved line change its direction?

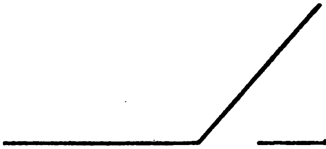
4. Can parallel lines meet? Why not?

5. Give an example of a straight line. A curved line. Parallel lines. Define each.

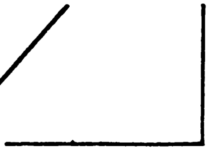
81. An **Angle** is the opening between two lines which meet at a point.



Acute Angle.



Obtuse Angle.



Right Angle.

6. Draw an acute angle. An obtuse angle. A right angle.

7. Which is the smallest? Which is the largest?

8. How many kinds of angles are there? Give an example of each.

9. With two lines make one angle. Make two angles. Make four angles. Can you make three angles with two lines?

10. With three lines can you make two angles? Three? Four? Five? Six? Seven? Eight? Nine? Ten? Twelve?

TABLE.

12 inches (in.) = 1 foot, ft.
3 feet = 1 yard, yd.
$5\frac{1}{2}$ yards = 1 rod, rd.
320 rods = 1 mile, mi.

1 mi. = 1760 yd. = 5280 ft.

A surveyor's chain (ch.) is 4 rd. = 66 ft. long.

ORAL EXERCISES.

11. How many inches in 3 ft.? 8 ft.? 9 ft.?

12. How many feet in 24 in.? 48 in.? 108 in.?

13. How many feet in 5 yd.? 6 yd.? 10 yd.?

14. How many yards in 27 ft.? 42 ft.? 60 ft.?

15. How many yards in 2 rd.? 4 rd.? 6 rd.?

16. How many rods in 11 yd.? 22 yd.? 33 yd.?

17. How many inches in 1 yd.? $\frac{1}{2}$ yd.? $\frac{1}{4}$ yd.?

18. What part of a yard is 9 in.? 12 in.? 18 in.?

19. How many rods in 2 miles? 10 miles?

20. How many yards in 30 ft.? 50 ft.? 60 ft.?

21. At $1.20 a yard, what will $2\frac{1}{2}$ yards of dress goods cost? $3\frac{1}{4}$ yd.? $1\frac{1}{8}$ yd.?

WRITTEN EXERCISES.

22. Reduce 8 yd. 2 ft. 9 in. to inches.

23. Reduce 4 rd. 4 yd. 2 ft. to feet.

24. Reduce 3 mi. 180 rd. 3 yd. to feet.

25. Reduce 12000 ft. to miles.

26. How many feet in $3\frac{3}{4}$ mi.?

27. How many miles in 42240 ft.?

28. How many feet in 10 chains? How many rods? How many inches?

29. What will $\frac{1}{2}$ of a mile of wire fence cost at 15 cents a foot?

30. A dug a ditch 20 rd. 10 ft. long at the rate of 10 cents a foot; how much did he receive?

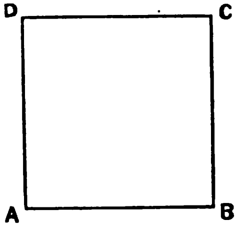
31. At 8 cents a foot, the Atlantic cable would cost $1351680; what is its length?

32. What will a telephone line 4 mi. 160 rd. long cost at the rate of $1.20 a rod?

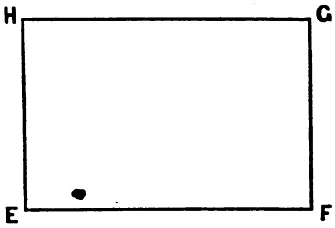
33. What will the rails for a tramway 1 mi. 60 rd. long cost at $20 a ton, if a yard of rail weighs 18 lb.?

SQUARE MEASURE.

82. Square Measure is used in measuring surfaces.



Square.



Rectangle.

83. A **Surface** is that which has length and breadth only.

A *square* is a surface which has four equal sides and four right angles; as, A B C D.

A *rectangle* is a surface which has four sides and four right angles; as, E F G H.

TABLE.

144 square inches (sq. in.). = 1 square foot, sq. ft.
9 square feet = 1 square yard, sq. yd.
30¼ square yards = 1 square rod, sq. rd.
160 square rods = 1 acre, A.
640 acres = 1 square mile, sq. mi.

10 square chains = 1 A.

ORAL EXERCISES.

1. How many square inches in 3 sq. ft.? In 5 sq. ft.?

2. How many square feet in 5 sq. yd.? In 8 sq. yd.?

3. How many square inches in $\frac{1}{4}$ of a square foot? In $\frac{1}{2}$ of a square foot? In $\frac{3}{4}$ of a square foot?

4. How many square rods in $\frac{1}{2}$ of an acre? In $\frac{1}{4}$ of an acre? In $\frac{3}{4}$ of an acre?

5. How many square yards in 81 sq. ft.?

WRITTEN EXERCISES.

6. How many square rods in 10 acres?

7. Reduce 4 A. 100 sq. rd. to square rods.

8. Reduce 12 sq. rd. to square inches.

9. Reduce 5280 sq. rd. to acres.

10. Reduce 1304 sq. in. to square feet.

11. Reduce 160 sq. ch. to acres.

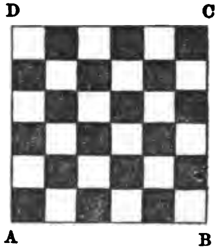
12. Reduce 1728 sq. in. to square feet.

APPLICATIONS OF SQUARE MEASURE.

THE RECTANGLE.

84. The **Area** of a rectangle is the number of square units it contains.

Thus, in the rectangle A B C D the area is the number of square units it contains, which is equal to the number in each row multiplied by the number of rows, and this is equal to the number of units in length multiplied by the number in the breadth. The area of A B C D is 6 × 6, or 36 square units.



Hence, *to find the area of a rectangle multiply the length by the width.*

1. How many square feet in a blackboard 12 feet long and 4 feet wide?

2. How many square feet in a yard 30 feet long and 20 feet wide?

3. How many square yards in a floor 33 feet long and 24 feet wide?

4. A field is 20 rods long and 8 rods wide; how many square rods in its surface?

5. A field is 80 rods long and 60 rods wide; how many acres does it contain?

6. A tract of land is 120 chains long and 60 chains wide; how many acres does it contain?

7. The length of a field is 72 rods, and its width is 20 rods; how many acres in the field?

8. The floor of a room contains 300 square feet; what is its width if it is 15 feet long?

9. A field containing 40 A. is 100 rods long; how wide is it?

10. My farm is in the form of a rectangle, and contains 20 acres; if it is 40 rods wide, what is its length?

11. How much will it cost to carpet a room 24 feet long and 18 feet wide, if the carpet is worth 80 cents a yard and is a yard wide?

12. What will it cost to paper the ceiling of a room 26 feet long and 15 feet wide at 12 cents per square yard?

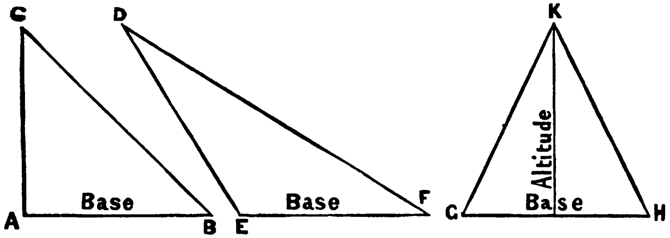
13. I made a board-walk from my house to my barn. It is 10 rods between the buildings; if the walk is 3 feet wide, what will the boards cost at $2.25 a hundred square feet?

14. What will it cost to paint the outside of a building 42 feet long, 16 feet wide, and 12 feet high, at 6 cents a square yard?

15. Required the cost of the bricks for a pavement 66 feet long and 9 feet wide, at $10 a thousand, if it takes 7 bricks for each square foot.

THE TRIANGLE.

85. A Triangle is a plane figure having three sides and three angles.



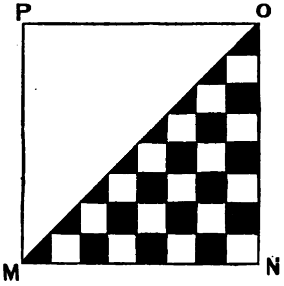
Right Triangle. Obtuse Triangle. Acute Triangle.

1. Make a right triangle. An obtuse triangle. An acute triangle. Mark the base of each.

2. Why is a right triangle so called? An obtuse triangle? An acute triangle?

3. What is a right triangle? An obtuse triangle? An acute triangle?

4. What is the base of a triangle? What is the altitude?



5. What part of the square M N O P is the triangle M N O?

6. If the square is 8 inches long and 8 inches high, what is its area?

7. How, then, can you find the area of the triangle?

Hence, *to find the area of a triangle multiply the base by one-half the altitude.*

8. A triangular board is 18 inches long and its altitude is 10 inches; what is its area?

9. A triangular field is 60 rods long and its altitude is 80 rods; what is its area in acres?

10. The altitude of a triangular piece of ground is 20 chains and its base is 40 chains; what is its area in acres?

11. The area of a triangle is 120 sq. ft.; what is its altitude if the base is 10 feet?

12. A piece of land in the form of a triangle contains 40 acres; what is its base if the altitude is 80 rods?

13. What is the value of a triangular piece of copper sheathing whose base is 1$\frac{2}{3}$ feet and altitude 10 inches, at $\frac{1}{3}$ of a cent a square inch?

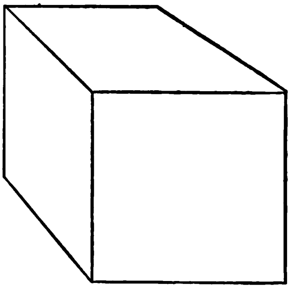
MEASURES OF VOLUME.

86. A **Volume** is that which has length, breadth, and thickness.

A **Cube** is a volume bounded by six equal squares.

A **Cubic Inch** is a cube whose sides are each a square inch.

A **Cubic Foot** is a cube whose sides are each a square foot.



A Cubic Inch.

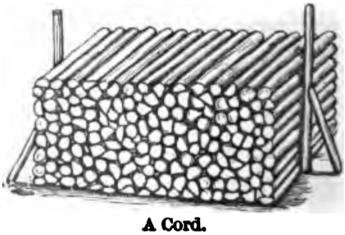
TABLE.

1728 cubic inches (cu. in.) = 1 cubic foot, cu. ft.
27 cubic feet = 1 cubic yard, cu. yd.

A **Cord of Wood** is a pile 8 feet long, 4 feet wide, and 4 feet high.

Hence 128 cubic feet = 1 cord.

In masonry 24$\frac{3}{4}$ cubic feet = 1 perch.



A Cord.

WRITTEN EXERCISES.

1. How many cubic inches in 20 cu. ft.?

2. How many cubic feet in 12 cords?

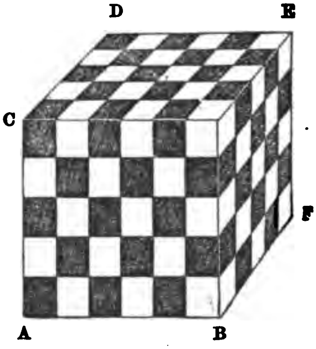
3. How many cubic feet in 16 perches?

4. Reduce 34560 cubic inches to cu. ft.

APPLICATIONS OF CUBIC MEASURE.

87. The **Contents** of a volume are the number of times it contains a small *cube* as a *unit of measure.*

In the volume ABCDEF the top has 6 cubes in a row, and there are 5 rows; hence there are 5 × 6, or 30 cubes, in one layer; and there are 5 layers, hence there are 5 × 30 cubes, or 150 cubes.



Hence, *to find the contents of a rectangular volume take the product of the three dimensions.*

1. How many cubic feet in a room 16 ft. long, 10 ft. wide, and 9 feet high?

2. A rectangular bin is 18 ft. long, 6 ft. wide, and 10 ft. high; how many cubic feet does it contain?

3. A coal-shed is 40 ft. long, 20 ft. wide, and 12 ft. high; how many cubic feet in it?

4. How many gallons of water will a tank hold that is 8 ft. long, 6 ft. wide, and 4 ft. high?

5. How many gallons of water in a cistern 9 ft. long, 7 ft. wide, and 5 ft. deep?

6. How many bushels in a bin 15 ft. long, 14 ft. wide, and 10 ft. high?

7. A cubical bin 10 ft. on a side is filled with wheat; how many bushels does it contain?

8. What will it cost to dig a cellar 30 ft. long, 25 ft. wide, and 6 ft. deep, at 15½ cents a cubic yard?

9. A wall is 80 ft. long, 3 ft. wide, and 6 ft. high; how many perches of stone does it contain?

10. A pile of stone is 40 ft. long, 30 ft. wide, and 8 ft. high; how many perches in it?

11. A pile of wood is 120 ft. long, 16 ft. wide, and 10 ft. high; how many cords of wood does it contain?

12. At $6.25 a cord, what will be the cost of a pile of wood 80 ft. long, 12 ft. wide, and 8 ft. high?

13. A load of bark measures 14 feet long, 4 feet 4 inches wide, and 3 feet 6 inches high; what is it worth at $5.95 a cord?

14. What is the weight of the water in a cistern 8 feet long, 4 feet wide, and 3 feet 3 inches deep, if a cubic foot weighs 62½ pounds?

15. A tank 4 feet long, 3 feet 3 inches wide, and 2 feet 6 inches deep is filled with oil; what is it worth at 22 cents a gallon?

16. A pile of stone is 15 feet long and 12 feet wide; how deep must it be to contain 18 perches?

Boards one inch thick are estimated by the square foot.

Thus, a board 16 ft. long, 12 in. wide, and 1 in. thick contains 16 sq. ft. or **Board-feet.**

When lumber is more than one inch thick, the thickness is taken into account, and the lumber is estimated by the *board-foot.*

Thus, a board 16 ft. long, 12 in. wide, and 2 in. thick contains 2 × 16, or 32 board-feet.

17. How many feet in a board 18 ft. long and 8 in. wide?

18. How many feet in a board 15 ft. long and 16 in. wide?

19. How many feet in a board 12 ft. long and 9 in. wide?

20. How many feet in 50 boards 16 ft. long and 16 in. wide?

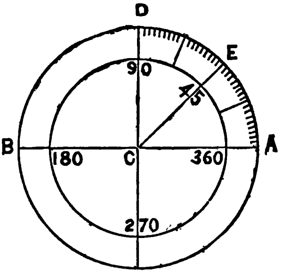
21. What are 20 boards 18 ft. long and 10 in. wide worth at $32.50 per 1000 feet?

22. What will be the expense of flooring a room 20 ft. long and 16 ft. wide with 1½-inch flooring at $30 per 1000 feet, allowing one-tenth for waste?

23. What will it cost to board the four sides of a house 30 feet long, 24 feet wide, and 18 feet high with inch boards, at $25 per 1000 feet?

CIRCULAR MEASURE.

88. Circular Measure is used in measuring arcs and angles.



A **Circle** is a plane figure bounded by a curved line, every point of which is equally distant from a point within called the *Centre.*

The bounding line is called the *Circumference.* The distance from the centre to the circumference is the *Radius;* as, C E.

A straight line passing through the centre and terminating in the circumference, as A B, is a *Diameter.*

Any part of the circumference, as A E, is an *Arc.*

For convenience of measuring the circumference is divided into 360 equal parts, called degrees. The angle A C E has 45° in it, and the angle A C D, a right angle, has 90°.

TABLE.

60 seconds (″) = 1 minute, ′.
60 minutes = 1 degree, °.
360 degrees = 1 circumference, C.

WRITTEN EXERCISES.

1. Reduce 30° 20′ 45″ to seconds.

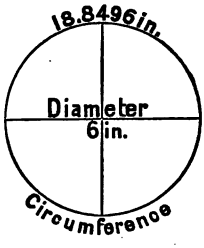
2. How many minutes in a circumference?

3. Reduce 62160′ to degrees.

4. Reduce 42345″ to degrees.

89. To find the circumference of a circle.

If we take a circular block 6 in. in diameter and measure the distance around it, we will find the circumference to be about 18.8496 in. Dividing the circumference, 18.8496 in., by the diameter, 6 in., we have 3.1416.



Hence, *to find the circumference multiply the diameter by 3.1416.*

1. What is the circumference of a circle whose diameter is 8 in.?

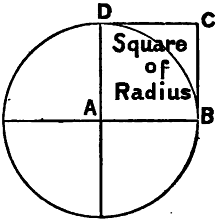
2. Find the circumference when the diameter is 12 ft.; 20 ft.; 40 ft.

3. How many yards around a circular fish-pond whose diameter is 80 yards?

4. Find the diameter whose circumference is 314.16 ft.

5. Find the diameter of a circle when the circumference is 1200 ft.

90. *To find the area of a circle, multiply the area of the square on the radius by 3.1416.*



1. Find the area of a circle whose radius is 10 inches.

PROCESS.—10 × 10 = 100; 100 × 3.1416 = 314.16.

2. What is the area of a circle whose diameter is 16 ft.? 20 ft.? 30 ft.?

3. A circular flower-bed is 12 ft. in diameter; what is its area?

4. A circular yard is 64 ft. in diameter; what is its area?

5. A circular island is 240 rods in diameter; how many acres does it contain?

6. How many acres in a circular field 10 chains in radius?

7. The circumference of a pond is 62.832 feet; what is its area?

8. How much larger is a square flower-bed 25 feet on a side than a circular one 25 feet in diameter?

9. A circular fish-pond which is 20 feet in diameter has a gravel-walk around it 10 feet wide; what is the area of the gravel-walk?

10. What is the difference between the areas of two circles, one having a diameter of 12 feet, and the other having a radius of 12 feet?

ORIGINAL PROBLEMS.

1. What will it cost to floor the school-room at $30 per 1000 ft.?

2. What will it cost to cover the floor of the school-room with matting at the market price?

3. How many square yards of carpet would it take to cover the school-room?

4. What would it cost to paint the school-room at 10 cents a square yard?

5. Measure a pile of wood and find the number of cords in it, and the cost at $5½ a cord.

6. Find the number of cubic feet of air in the school-room. How many bushels would it hold?

7. Measure a field and find its area; also the cost at market price.

8. Make similar problems suited to the capacity of the pupils.

DIFFERENCE IN TIME.

1. Abraham Lincoln was born Feb. 12, 1809, and died April 15, 1865; what was his age?

PROCESS.

yr.	mo.	da.
1865	4	15
1809	2	12
56 yr.	2 mo.	3 da., *Ans.*

We write the earlier date under the later, putting the number of the year, month, and day in the proper order as shown in the margin, and subtract the one from the other, allowing 30 days to a month and 12 months to a year.

2. James A. Garfield was born Nov. 19, 1831, and died September 19, 1881; what was his age?

3. Ulysses S. Grant was born April 27, 1822, and died July 23, 1885; what was his age?

4. Chester A. Arthur was born Oct. 5, 1830, and died Nov. 18, 1886; what was his age?

5. Benjamin Harrison was born Aug. 20, 1833, and was inaugurated president, March 4, 1889; how old was he when inaugurated?

6. Grover Cleveland was born March 18, 1837, and was inaugurated president, March 4, 1885; how old was he when inaugurated?

7. George Washington was born Feb. 22, 1732, and died Dec. 14, 1799; what was his age?

8. How old was Washington when inaugurated president, April 30, 1789?

9. President Lincoln was assassinated April 14, 1865, and President Garfield was assassinated July 2, 1881; how much time between these two events?

10. The Revolution began on the 19th of April, 1775, and ended January 20, 1783; how long did it continue?

11. America was discovered by Columbus Oct. 11, 1492; how long from that date to the present time?

12. Benjamin Franklin was born Jan. 6, 1706, and died April 17, 1790; required his age.

13. The Revolution began April 19, 1775, and the Civil War began April 11, 1861; how much time between these two events?

14. How many years, months, and days from your birthday to the present time?

NOTE.—When the time of a note is required, the exact number of days is usually calculated.

15. How many days has a note run which was dated April 1, 1894, and was paid Sept. 3, 1894?

PROCESS.

April,	29
May,	31
June,	30
July,	31
Aug.,	31
Sept.,	3
	155 days.

The number of days left in April is 29, May, July, and August each have 31 days, and June has 30. From Sept. 1st to Sept. 3d is 3 days. Adding, the required number of days is 155, *Ans.*

16. A note was given May 4, 1890, and paid Aug. 18, 1890; how long did it run?

17. What is the exact number of days from June 20, 1891, to Dec. 15, 1891?

18. A note was given Nov. 25, 1893, and paid March 4, 1894; how long did it run?

19. What is the exact number of days from Jan. 1, 1892, to July 10, 1892?

20. A note dated July 5, 1890, was paid in 93 days; what was the date of payment?

21. A note dated April 1, 1886, was paid in 63 days; what was the date of payment?

22. A note was given Dec. 20, 1890, and paid Aug. 4, 1891; how long did it run?

23. How many days from the 4th of March, 1889, to the 4th of July, 1890?

Find the exact number of days from—

24. May 6, 1894, to Oct. 6, 1894.

25. Feb. 22, 1890, to July 4, 1890.
26. Aug. 10, 1892, to Jan. 1, 1893.
27. June 9, 1894, to Oct. 17, 1894.
28. May 10, 1890, to Nov. 1, 1890.

GENERAL REVIEW.

1. Reduce 3592 ounces to pounds.
2. Reduce 512 pints to gallons.
3. Reduce 704 pints to bushels.
4. Reduce 10080 minutes to days.
5. Reduce 5½ miles to feet.
6. Reduce 40 chains to feet.
7. How many square rods in 14 acres?
8. How many cubic feet in 400 cubic yards?
9. How many seconds in 20 degrees?
10. Reduce 420 pounds to ounces.
11. Reduce 63 gallons to pints.
12. Reduce 212 bushels to quarts.
13. Reduce 30 days to seconds.
14. Reduce 60720 feet to miles.
15. Reduce 8118 feet to chains.
16. Reduce 5120 square rods to acres.
17. Reduce 174528 cubic inches to cubic feet.
18. Reduce 21600″ to degrees.
19. Reduce 1 T. 75 lb. 12 oz. to ounces.
20. Reduce 20 gal. 1 qt. 1 pt. to pints.
21. Reduce 10 bu. 3 pk. 7 qt. to quarts.
22. Reduce 4 wk. 5 da. 10 hr. to hours.
23. Reduce 2 mi. 120 rd. 1 ft. to feet.
24. Reduce 2 A. 140 sq. rd. to square rods.
25. Reduce 416 cords to cubic feet.
26. Reduce 396 cu. ft. to perches.
27. How many cubic inches in 25 gallons?
28. How many gallons in 71610 cubic inches?

29. How many cubic inches in 20 bushels?

30. How many cords of wood in 25856 cubic feet?

31. How many acres in 4210 square chains?

32. How many feet in 100 miles?

33. Methuselah died at the age of 969 years; how many days was this (365¼ days to a year)?

34. A boy gathered 1½ bushels of chestnuts, and sold them at 8 cents a quart; what did he receive?

35. How many pens in 30 boxes, if each box contains one gross?

36. How many cords in a pile of wood 64 feet long, 16 feet wide, and 12 feet high?

37. When sweet potatoes are selling at 30 cents a half-peck, what are they worth a bushel?

38. At 3 cents a pint, what is the milk-bill for one year of a family which uses 2 quarts each day?

39. What will 20 pounds of spice cost at the rate of 2 cents an ounce?

40. A man bought 20 dozen of eggs at 35 cents a score; what did they cost?

41. How many steps of 3 feet each will a person take in going from New York to Philadelphia, a distance of 90 miles?

42. How many ink-wells will 3 gallons of ink fill, if each well holds half a gill?

43. How many quart-baskets will 5 bu. 3 pk. of blackberries fill?

44. When apples are selling at $1.60 a bushel, what are they worth a half-peck?

45. When coal is selling at $5 a ton, what is it worth per hundredweight?

46. How many sheets of paper in 4½ reams and 4½ quires?

47. A dug a mile of ditch at $1.50 a rod; how much did he receive?

48. How many bushels of chestnuts can be bought for $12.80 at 10 cents a quart?

49. What will 60 rods of fence cost at the rate of 90 cents a foot?

50. What will it cost to enclose a field 40 rods long and 20 rods wide with a fence that costs $1.25 a foot?

51. What will it cost to paint the outside of a building 60 feet long, 40 feet wide, and 30 feet high, at $1.75 per one hundred square feet?

52. What is the value of a triangular piece of land whose base is 60 rods and the altitude 50 rods, at $120 an acre?

53. What is the entire surface of a cubical box each of whose sides is 10 ft.?

54. How many perches of stone in a pile 12 feet long, 8 feet high, and 10 feet wide?

55. How many feet in a board 16 feet long and 15 inches wide?

56. How many feet in a board 8 feet long and 9 inches wide?

57. How many board-feet in a plank 18 feet long, 16 inches wide, and 2 inches thick?

58. How wide is a board 12 feet long which contains 20 board-feet?

59. How wide is a 2-inch plank that is 16 feet long and contains 32 board-feet?

60. What will 15 planks 20 feet long, 12 inches wide, and 3 inches thick cost, at $50 a thousand?

61. What will it cost to cover a yard 180 feet long and 20 feet wide with earth 18 inches deep, at 40 cents a cubic yard?

62. How many perches of stone will be required to cover a pike 18 inches deep, providing the pike is 36 feet wide and one-half mile long?

63. What will it cost to cover a floor with oilcloth at 75 cents a square yard, if the floor is 20 feet long and 8 feet wide, no allowance being made for waste or matching?

64. What will it cost to cover a parlor 24 feet long and 18 feet wide with Brussels carpet ¾ of a yard wide, if the strips are run lengthwise and the matching of the figures requires 9 inches to be cut from each piece except the first, the carpet costing $1.75 a yard?

65. What will it cost to plaster a school-room 50 ft. long, 36 ft. wide, and 15 ft. high, at $12 per thousand square feet, an allowance of 25 sq. yd. being made for doors and windows?

66. How many barrels of water will a cistern hold which is 10 feet square and 9 feet deep, a barrel containing 31½ gallons?

67. What will be the cost of the wood that can be piled in a shed 30 feet long, 20 feet wide, and 12 feet high, at $5.25 a cord?

68. A has a circular field and B has a square one: the diameter of A's field is 16 rods, and the side of B's field is 16 rods; how much larger is B's field than A's?

69. What will it cost to pave a yard 60 feet long and 30 feet wide, if each square foot requires 7 bricks, and bricks are worth $10.50 a thousand?

70. Mr. Maynard agreed to dig the cellar of a house 40 feet long and 36 feet wide, the cellar being 6 feet deep, for $100: he employed a laborer who charged him 25 cents a cubic yard; what did Mr. Maynard make by the transaction?

71. A merchant bought 8 hogsheads of molasses, each containing 63 gallons, at $20.25 a hogshead: he sold 3 hogsheads at 50 cents a gallon, and the remainder at 45 cents a gallon; how much did he gain?

72. A milk-dealer sells daily 10 cans of milk, each holding 15 gal. 3 qt.; what is the value of the milk sold in 4 weeks (6 days each), at 6 cents a quart?

73. How many cubic feet of earth must be removed to dig a trench one-fourth of a mile long, 4½ feet wide, and 3 feet deep?

74. A bin 8 feet wide, 12 feet long, and 6 feet high is ¾ full of wheat; what is it worth at 50 cents a bushel?

SECTION VI.

PERCENTAGE.

ORAL EXERCISES.

91. THE term *per cent.* means by the hundred. Thus, one per cent. of a number is one-hundredth of it; two per cent., two-hundredths of it; three per cent., three-hundredths of it; and so on.

1. How many hundredths of a number is 4 per cent.? 5 per cent.? 6 per cent.? 10 per cent.? 20 per cent.? 25 per cent.?

2. What per cent. of a number is 3 hundredths of it? 6 hundredths of it? 7 hundredths of it? 10 hundredths of it? 15 hundredths of it? 25 hundredths of it?

3. What per cent. of a number is $\frac{5}{100}$ of it? $\frac{8}{100}$ of it? $\frac{10}{100}$ of it? $\frac{50}{100}$ of it? $\frac{60}{100}$ of it?

4. What per cent. of a number is .05 of it? .06 of it? .10 of it? .20 of it?

The symbol % is used to denote *per cent.* Thus, 6% means 6 per cent., and 10% means 10 per cent.

5. Express 5% decimally. 10%. 12%. 15%. 20%. 25%. $33\frac{1}{3}$%.

6. Express 6% decimally. 8%. 16%. 50%. 75%.

7. Express 7% fractionally. 11%. 13%. 15%. 30%. 40%.

8. Express 8% fractionally. 10%. 50%. 75%.

9. Express 12% fractionally. 16%. 28%. 36%. 80%.

Express the following per cents. decimally and fractionally in their lowest terms:

Thus, 5% = .05 = $\frac{5}{100}$ = $\frac{1}{20}$.

10. 4%.
11. 6%.
12. 7%.
13. 8%.
14. 10%.
15. 20%.
16. 25%.
17. 30%.
18. 40%.
19. 50%.
20. 75%.
21. 90%.
22. 100%.
23. 125%.
24. 150%.
25. 200%.

92. To find any per cent. of a number.

ORAL EXERCISES.

1. What is 10% of 40?

SOLUTION.—10% of 40 is $\frac{10}{100}$ or $\frac{1}{10}$ of 40, which is 4.

2. What is 10% of 20? Of 30? Of 60? Of 80?
3. What is 20% of 25? Of 35? Of 50? Of 75?
4. What is 25% of 16? Of 24? Of 36? Of 60?
5. What is 50% of 20? Of 30? Of 40? Of 80?
6. What is 75% of 12? Of 20? Of 28? Of 36?
7. What is 1% of 200? Of 300? Of 400? Of 500?
8. What is 7% of 500? Of 600? Of 800? Of 400?
9. What is 6% of 50? Of 100? Of 150? Of 200?
10. What is 12$\frac{1}{2}$% of 24? Of 40? Of 64? Of 72?

SUGGESTION.—12$\frac{1}{2}$% of a number = $\frac{1}{8}$ of it.

11. What is 16$\frac{2}{3}$% of 12? Of 36? Of 54? Of 72?
12. What is 33$\frac{1}{3}$% of 30? Of 45? Of 17? Of 22?

WRITTEN EXERCISES.

13. What is 5% of 315?

PROCESS.

$$\begin{array}{r} 315 \\ .05 \\ \hline 15.75 \end{array}$$ *Ans.*

5% of 315 is .05 times 315, which by multiplication is 15.75.

NOTE.—This form of solution is preferred for written work.

14. What is 6% of 22?

15. What is 7% of 123?

16. What is 10% of 428 acres?

17. What is 20% of 425 miles?

18. What is 8% of 450 tons?

19. What is 7% of $625?

20. What is 15% of 3000 horses?

21. What is 21% of 62 pounds?

22. A farmer sold land which cost him $227 an acre at a gain of 20%; what was his gain?

23. A teacher's salary is $1500, and his expenses are 40% of his salary; how much does he save?

24. A bought a house for $5760, and sold it at a gain of 5%; what did he receive for it?

25. B's farm cost him $10250. On account of the panic of 1893 he was obliged to sell it at a loss of 12%; how much did he lose?

26. In a bed of iron ore 30% is pure iron; how much iron will 6787 pounds of ore produce?

27. In a school of 1040 pupils 65% of them are girls; how many girls in the school?

28. A merchant failed in business, and was able to pay only 35% of his debts; how much would A receive from a debt of $4860?

93. To find what per cent. one number is of another.

ORAL EXERCISES.

1. What per cent. of 15 is 5?

SOLUTION.—15 is 100% of itself, and 5, which is $\frac{5}{15}$, or $\frac{1}{3}$ of 15, is $\frac{1}{3}$ of 100%, or $33\frac{1}{3}\%$.

The same result may be obtained by dividing 5 by 15. Thus,

$$\begin{array}{r} 15\overline{)5.00} \\ .33\frac{1}{3}\text{, or } 33\frac{1}{3}\%. \end{array}$$

2. What per cent. of 40 is 4? 8? 10? 20?
3. What per cent. of 50 is 5? 10? 20? 25?
4. What per cent. of 60 is 6? 12? 20? 45?
5. What per cent. of 80 is 20? 40? 60? 10?
6. What per cent. of 400 is 100? 200? 300? 600?
7. What per cent. of 600 is 30? 60? 100? 300?
8. What per cent. of 25 is 1? 4? 7? 8? 12?
9. What per cent. of 20 is 1? 7? 9? 12? 16?
10. What per cent. of 24 is 6? 4? 3? 8? 12?

WRITTEN EXERCISES.

11. What per cent. of 160 is 8?

PROCESS.

160)8.00(.05, or 5%, *Ans.*
8.00

Since 160 multiplied by some rate is 8, that rate is 8 ÷ 160, which is .05, or 5%.

12. What per cent. of 800 is 48?
13. What per cent. of 700 is 35?
14. What per cent. of 450 is 45?
15. What per cent. of 75 is 37.5?
16. What per cent. of 72 is 54?
17. What per cent. of 126 is 42?
18. What per cent. of 216 is 36?
19. What per cent. of 42 is 10.5?

What per cent.—

20. Of 32 lb. is 3.2 lb.?
21. Of 425 acres is 212.5 acres?
22. Of $150 is $60?
23. Of 6.5 tons is .52 tons?
24. Of 900 men is 150 men?
25. Of 845 yd. is 202.8 yd.?

26. A teacher saves $200 out of a salary of $800; what per cent. of his salary does he save?

27. A farmer raised 1250 bushels of grain, and sold 250 bushels; what per cent. of the whole crop did he sell?

28. In a school of 900 pupils, 600 of them are girls; what per cent. of the whole number are girls?

29. A horse which cost $200 was sold at a gain of $40; what was the gain per cent.?

30. A carriage which cost $150 was sold for $25 less than cost; what was the loss per cent.?

94. To find a number when any per cent. of it is given.

ORAL EXERCISES.

1. 6 is 25% of what number?

SOLUTION.—Since 6 is 25%, or $\frac{1}{4}$, of some number, $\frac{4}{4}$, or that number, is 4 × 6, or 24.

The same result can be obtained by dividing 6 by .25, which is 24.

2. 8 is 25% of what number? 10%? 20%?
3. 12 is 10% of what number? 20%? 5%?
4. 20 is 20% of what number? 75%? 50%?
5. 30 is 25% of what number? 30%? 60%?
6. 60 is 12% of what number? 3%? 15%?
7. 50 is 5% of what number? 10%? 20%?
8. 200 is 4% of what number? 8%? 25%?

WRITTEN EXERCISES.

9. 36 is 6% of what number?

PROCESS.
.06)36.00
600, *Ans.*

If 6%, or .06, of some number is 36, that number is 36 ÷ .06, which is 600.

10. 75 is 15% of what number?
11. 124 is 40% of what number?
12. 75 is 5% of what number?

13. 26 is 13% of what number?

14. 105 is 35% of what number?

15. 224 is 7% of what number?

16. 361 is 19% of what number?

17. 176 is 8% of what number?

18. 156 is 12% of what number?

19. 415 acres is 50% of what number?

20. A merchant sold $528 worth of goods, which was 15% of his stock; what was his stock?

21. A sold his house at a gain of $241, which was 5% of the cost; what was the cost?

22. James sold his horse at a gain of 25%, and thereby cleared $62.50; what did he pay for the horse?

23. I sold some damaged goods at 10% below cost, and thus lost 40 dollars; what was the cost?

24. A lawyer saves $450 a year, which is 8% of his entire earnings; what is his yearly income?

GENERAL REVIEW.

1. A merchant makes a reduction of 5% from a bill of $350.50; how much must be paid him?

2. A grocer sold tea that cost him $.80 for $1; what per cent. did he gain?

3. A miller sold 40 barrels of flour, which were 10% of all he had; how many barrels had he at first?

4. A teacher's salary was increased 30%, making it $2600; what was it before the increase?

5. A man sold a horse for $75, and thereby lost 25%; what was the cost of the horse?

6. A had a flock of 600 sheep, and sold 33⅓% of them; how many remained?

7. A boy had 125 papers, and sold 20% of them; how many remained?

8. What per cent. will be gained on land that is bought at \$80 and sold at \$120 an acre?

9. A sold 25% of his farm for \$2000; what was his farm worth?

10. A carriage was bought at \$125, and sold at \$100; what was the loss per cent.?

11. What per cent. of 625 is 500?

12. 220 is 40% of what number?

13. What is 62½% of 72?

14. A farmer raised 1260 bushels of grain: 50% of it was corn, 33⅓% of it was wheat, and the remainder was oats; how many bushels of each kind did he raise?

15. A tax-collector receives 5% for collecting the school-tax, which is \$9280; how much does he receive for his services?

16. A farm was bought at \$150 an acre and sold at a gain of 33⅓%; what was the selling price?

17. For what sum must I sell a horse which cost me \$200 to gain 40%?

18. A's house was bought for \$8400 and sold for \$10,500; what was the gain per cent.?

19. B bought a lot for \$800 and paid \$600 cash; what per cent. of the cost remained unpaid?

20. A grocer deducted 5% from a bill of \$640; what sum would pay the bill?

21. An army of 9000 men returned from the field of battle with only 5400 men; what per cent. were missing?

22. A merchant bought goods for \$8000 and sold them at a gain of 15%; what did he receive for them?

23. A horse which cost \$4000 was sold, on account of the panic of 1893, for \$3000; what was the loss per cent.?

24. My income is \$1800: I pay 25% for living expenses and 30% for all other expenses; how much do I save?

25. A bought goods which cost him \$1200: A sold them to

B at an advance of $33\frac{1}{3}\%$, and B sold them to C at a loss of 20%; what did C pay for them?

26. A farm was sold at a gain of $2125, which was at a gain of 25%; what was the cost?

27. A man bought a book for $4 and sold it for $5; what was the gain per cent.?

28. A merchant gained $12\frac{1}{2}\%$ by selling his goods at a gain of $200; what did the goods cost him?

29. By selling a horse for $23.50 less than cost I lost 10%; what did the horse cost me?

30. An agent buys pencils for 1 cent and sells them for 2 cents; what does he gain per cent.?

INTEREST.

95. **Interest** is money paid for the use of money.

ORAL EXERCISES.

1. Mr. Noble paid $5 a year for the use of $100; what per cent. of the money did he pay?

2. What per cent. of $100 is $6 a year? $4? $10? $8? $7?

3. If I borrow $100, and pay $5 a year for the use of it, what rate of interest do I pay?

4. What is the interest of $100 for one year at 5%? 6%? 7%?

5. What is the interest of $200 for one year at 5%? 6%? 7%?

6. What is the interest of $300 for one year at 5%? 6%? 7%?

7. What is the interest of $100 for 2 years at 5%? 6%? 7%?

8. What is the interest of $100 for 3 years at 5%? 6%? 7%?

9. What is the interest of $200 for 2 years at 4%?

10. What is the interest of $400 for 2 years at 6%?

11. What is the interest of $200 for 2 years at 5%?

WRITTEN EXERCISES.

12. What is the interest of $400 for 3 yr. 6 mo. at 6%?

PROCESS.

$400
.06
$24
$3\frac{1}{2}$
$84, *Ans.*

The interest of $400 for 1 yr. at 6% is .06 times $400, which is $24; and the interest for 3 yr. 6 mo., or $3\frac{1}{2}$ yr., is $3\frac{1}{2}$ times $24, which is $84.

Find the interest—

13. Of $200 for 4 yr. at 6%.

14. Of $350 for 5 yr. at 7%.

15. Of $240 for 3 yr. at 8%.

16. Of $600 for 5 yr. at 5%.

17. Of $1080 for 3 yr. at 10%.

18. Of $1600 for 6 yr. at 6%.

19. Of $400 for 4 yr. 6 mo. at 5%.

20. Of $800 for 5 yr. 9 mo. at 6%.

21. Of $1200 for 8 yr. 8 mo. at 8%.

22. Of $240 for 6 yr. 10 mo. at 5%.

23. Of $600 for 4 yr. 6 mo. 15 da. at 8%.

PROCESS.

$600
.08
$48.00, Int. for 1 yr.
$4\frac{13}{24}$
$192, Int. for 4 yr.
26, Int. for $\frac{13}{24}$ yr.
$218, *Ans.*

15 da. = $\frac{15}{30}$, or $\frac{1}{2}$ mo.; $6\frac{1}{2}$ mo. = $\frac{13}{2}$ mo., or $\frac{13}{24}$ yr. Hence, the time is $4\frac{13}{24}$ yr.

The interest for 1 yr. is $48, and for $4\frac{13}{24}$ yr. it is $4\frac{13}{24}$ times $48, which is $218.

24. Of $600 for 6 yr. 6 mo. 10 da. at 6%.

25. Of $1200 for 7 yr. 8 mo. 20 da. at 5%.

26. Of $2000 for 5 yr. 5 mo. 15 da. at 6%.

27. Of $1560 for 4 yr. 6 mo. 12 da. at 6%.

96. The **Principal** is the sum on which interest is charged.

97. The **Amount** is the sum of principal and interest.

What is the amount—

28. Of $600 for 4 yr. 8 mo. at 5%?
29. Of $1200 for 8 yr. 4 mo. 10 da. at 6%?
30. Of $325.40 for 3 yr. 6 mo. 15 da. at 5½%?
31. Of $72.36 for 5 yr. 9 mo. 20 da. at 6%?
32. Of $96.72 for 10 yr. 10 mo. 10 da. at 10%?

98. Six per cent. method.

1. At 6%, what is the interest on $1 for 12 mo.?

2. If the interest for 12 mo. is 6 cents, what part of the number of months expresses the number of cents?

3. If the interest for 12 mo. is $.06, what is the interest for 1 mo.?

4. If the interest for 1 mo., or 30 da., is 5 mills, what part of the number of days is mills?

Then, at 6%, we may call ½ of the number of months cents, and ⅙ of the number of days mills.

5. What is the interest of $500 for 2 yr. 6 mo. 12 da. at 6%?

PROCESS.

The int. of $1 for 2 yr. = $.12
" " 6 mo. = .03
" " 12 da. = .002
The int. of $1 for 2 yr. 6 mo. 12 da. = $.152
500
$76.000, *Ans.*

Find the interest—

6. Of $120 for 4 mo. 6 da. at 6%.
7. Of $240 for 10 mo. 12 da. at 6%.
8. Of $225 for 2 yr. 8 mo. 18 da. at 6%.
9. Of $1000 for 3 yr. 6 mo. 24 da. at 6%.
10. Of $1200 for 5 yr. 10 mo. 15 da. at 6%.

11. Of $1500 for 6 mo. at 6%.
12. Of $800 for 60 da. at 6%.
13. Of $250 for 90 da. at 6%.
14. Of $125 for 93 da. at 6%.
15. Of $400 for 8 mo. at 5%.

SUGGESTION.—Find the interest at 6%, and take $\frac{5}{6}$ of the result.

16. Of $140 for 2 yr. 10 mo. at 5%.
17. Of $300 for 3 yr. 8 mo. at 5%.
18. Of $1000 for 2 yr. 18 da. at 7%.
19. Of $1500 for 1 yr. 2 mo. at 7%.
20. Of $350 for 3 yr. 4 mo. at 8%.
21. Of $1200 for 6 yr. 8 mo. 12 da. at 5%.
22. Of $4800 for 10 yr. 9 mo. 18 da. at 7%.
23. Of $3600 for 2 yr. 10 mo. 24 da. at 6%.
24. Of $3060 for 5 yr. 5 mo. 6 da. at 7%.
25. Of $50 for 3 yr. 8 mo. 27 da. at 9%.

Find the amount—

26. Of $4020 for 6 yr. 6 mo. 6 da. at 6%.
27. Of $360 for 12 yr. 2 mo. at 5½%.
28. Of $2000 for 1 yr. 4 mo. 9 da. at 6½%.
29. Of $400.50 for 5 yr. 4 mo. 3 da. at 7%.
30. Of $120 for 2 yr. 8 mo. at 8%.
31. Of $840 for 2 yr. 3 mo. 21 da. at 6%.
32. Of $1040 for 3 yr. 4 mo. 18 da. at 5%.
33. Of $380 for 3 yr. 6 mo. 12 da. at 6%.
34. Of $324 for 6 yr. 10 mo. 18 da. at 5%.
35. Of $4060 for 9 yr. 2 mo. 3 da. at 6%.
36. Of $400 for 1 yr. 2 mo. 3 da. at 4%.

99. When money is borrowed from a bank, interest is charged for 3 days more than the given time. This *interest* is called **Bank Discount.**

The **Proceeds** of a note is the sum received for it when discounted. It equals the amount of the note less the discount.

1. Find the interest or bank discount of $200 for 60 da. at 6%.

2. Find the bank discount of $120 for 90 da. at 6%.

3. Find the bank discount of $200 from June 20th to Aug. 14th at 6%.

4. Find the bank discount of $150 from May 10th to July 20th at 6%.

5. A note for $600, at 90 days, was discounted at a bank at 6%; what were the proceeds?

6. A note for $840, at 60 days, was discounted at a bank at 7%; what were the proceeds?

7. A note for $1200, at 30 days, was discounted at a bank at 8%; what were the proceeds?

8. A note for $250, due in 90 days, was discounted at a bank at 6%; what were the proceeds?

9. A note for $1260, due in 60 days, was discounted at a bank at 7%; required the proceeds.

10. A note for $3000, due in 30 days, was discounted at a bank at 8%; what were the proceeds?

11. I gave my note to Mr. Byerly for $125.75, payable in 60 days: Mr. Byerly had it discounted at bank at 10%; what did he receive for it?

MISCELLANEOUS PROBLEMS.

100.—*1.* A has $8050, B has $4220 more than A, and C has twice as much as A and B together; what is the sum of their fortunes?

2. A farmer has 1028 bushels of wheat, 439 bushels less of oats, and sufficient corn to make the entire quantity of grain 2500 bushels; how much corn has he?

3. A has $615, B has 4 times as much as A, and C lacks

$1000 of having 22 times as much as both A and B; required the sum of their fortunes.

4. Two men set out from the same point and travel in opposite directions; one travels 40 miles a day and the other 32 miles a day; how far apart will they be in 212 days?

5. Two men set out from the same point and travel in the same direction: one travels 60 miles a day, and the other 41 miles a day; how far apart will they be in 171 days?

6. A drover bought 160 cows at 32 dollars each, and sold $\frac{1}{4}$ of them at cost; how much must he receive a head for the remainder to gain $840?

7. A bought a quantity of wheat for 3220 dollars: he paid 120 dollars for transportation and 50 dollars for storage, and sold it so as to gain 500 dollars; what did he receive for it?

8. Harold can ride 60 miles a day on his bicycle, and Harry 42 miles; how much farther can Harold ride in 65 days than Harry?

9. If 45 men earn $2025 in a month, and 135 boys earn the same sum in the same time, how much will 20 boys and 30 men earn in a month?

10. Eight horses and 12 cows are worth $1788; if the average price of a cow is $41, what is the average price of a horse?

11. How long will it take two boys, starting at the same place and traveling in the same direction, to be 1224 miles apart, if one goes 32 miles a day, and the other 44?

12. If the driving-wheel of a locomotive is 18 feet in circumference, how many revolutions will it make in going from Philadelphia to New York (90 miles), there being 5280 feet in a mile?

13. A young man having received a fortune of $30,000, reserved $3000, and shared the remainder equally with his 5 sisters and 3 brothers; required the amount received by each of them.

14. If a man receive 160 pounds of sugar in exchange for

40 pounds of butter at 20 cents a pound, what is the price of the sugar per pound?

15. A man bought 20 barrels of sugar at $12 a barrel, and 30 barrels at $15 a barrel; how much would he gain by selling the whole at $14 a barrel?

16. Multiply the sum of 312 and 216 by their difference.

17. A drover went West with $4280 to buy horses and cows: he bought horses at $84 a head and an equal number of cows at $23 a head; how many of each kind did he buy?

18. The President of the United States receives a salary of $50,000 a year; what is his average salary per day, counting 365 days to the year?

19. If a boy earns $16.50 a month, and a man $45.18 a month, how much will 10 boys and 16 men earn in 5 months?

20. The earth's orbit is 580,000,000 miles in length, which the earth travels in about 365 days; what is its rate per day?

21. The average speed of a horse is about 5 miles an hour; how far can a horse travel while a locomotive goes 3200 miles at the rate of 32 miles an hour?

22. If 8 bushels of apples cost $9.60, what will 57 bushels cost?

23. If a laborer earns $3.15 a day, and pays 60 cents a day for his board, how much can he save in 4 weeks?

24. The sum of two numbers is 2750, and the larger is 50 more than the smaller; what are the numbers?

25. A farmer took 1000 eggs to the store and sold them at 30 cents a dozen; what did he receive for them?

26. A miller bought 112 barrels of flour for $1200: he sold 60 barrels at $9.50 a barrel, and the remainder at $12 a barrel; did he gain or lose, and how much?

27. What is the sum of $\frac{2}{3}$, $\frac{3}{5}$, $\frac{5}{7}$, and $\frac{7}{9}$?

28. Reduce $315\frac{12}{37}$ to an improper fraction.

29. Reduce $\frac{8016}{29}$ to a mixed number.

30. Reduce $\frac{2160}{2304}$ to its lowest terms.

31. Subtract the sum of $\frac{2}{3}$ and $\frac{5}{7}$ from $2\frac{1}{2}$ times $3\frac{1}{7}$.

32. Reduce $1\frac{7}{11}$ of $5\frac{1}{9}$ of $\frac{1}{46}$ to a simple fraction.

33. Divide $\frac{2}{3}$ of $\frac{19}{30}$ by $\frac{7}{8}$ of $\frac{11}{12}$.

34. If $\frac{2}{3}$ of a barrel of flour cost \$8.40, what will 10 barrels cost?

35. The difference of two numbers is $42\frac{34}{35}$, and the greater $59\frac{13}{15}$; what is the less?

36. How many pounds of coffee can be bought for \$$45\frac{2}{5}$, at \$$\frac{5}{16}$ a pound?

37. A grocer bought 100 barrels of flour at \$$4\frac{1}{8}$ a barrel: he sold 51 barrels at \$$5\frac{3}{8}$ per barrel, and the remainder at \$$6\frac{1}{4}$ per barrel; how much did he gain?

38. A farmer bought 8 horses at \$$125\frac{1}{2}$ apiece, 12 cows at \$$41\frac{2}{5}$ apiece, and 2 wagons at \$$16\frac{4}{5}$ each; what did they all cost?

39. A merchant in selling $12\frac{4}{5}$ pounds of sugar, at the rate of 16 pounds for \$1, gains $9\frac{3}{5}$ cents; what was the cost of the sugar per pound?

40. A gentleman's suit of clothes cost \$40, and $\frac{5}{8}$ of the cost of the suit was twice the cost of the hat; what was the cost of the hat?

41. A and B built a wall: A built 60 rods, which was $\frac{3}{4}$ as much as B built; what was the entire length of the wall in feet?

42. A person made a journey of 120 miles, traveling $\frac{1}{3}$ of the distance the first day, $\frac{1}{4}$ of the remainder the second day, and $\frac{2}{5}$ of the remainder the third day; how many miles remained to be traveled?

43. John, being asked his age, replied that if he were 5 times as old, $\frac{1}{6}$ of his age would be 15 years; how old was he?

44. When tenths are multiplied by tenths, what denomination is the product? Tenths by hundredths? Tenths by thousandths? Hundredths by hundredths? Hundredths by thousandths?

45. Find the area of a triangle whose base is 10 chains and altitude 8 chains.

46. What will it cost to build a wall 40 ft. long, 11 ft. high, and 1½ ft. thick, at $2½ a perch?

47. What will the material cost to build a wall 120 ft. long, 2½ ft. wide, and 3 ft. 6 in. high, at $1.10 a perch?

48. Andrew Jackson was born March 15, 1767, and died June 8, 1845; required his age.

49. A man spent 30% of his income for books, 25% for clothing, and saved $900; what was his income?

50. A bought a house for $2384, and sold it at a gain of 25%; what was his gain?

51. B lost 20% by selling a horse for $120; what did the horse cost him?

52. If a book is bought for $16, and sold for $20, what is the gain per cent.?

53. 420 is 60% of what number?

54. If I buy lead-pencils at 2 cents and sell them for 5 cents, what is the gain per cent.?

55. What is the interest on $1260 for 5 yr. 9 mo. 13 da. at 8%?

56. Required the amount of $3600 for 8 yr. 10 mo. 15 da. at 7%.

57. A horse was sold for $250, which was a gain of 25%; required the cost.

58. A carriage was bought for $180 and sold for $160; what was the loss per cent.?

59. To what decimal is ¼% equal?

60. To what per cent. is .005 equal?

61. What is the interest on $2400 for 3 yr. 4 mo. 18 da. at 6%?

62. Required the amount of $420 for 10 yr. 10 mo. 12 da. at 7%.

63. A note for $1200, due in 90 days, was discounted at a bank at 6%; required the proceeds.

64. A tax-collector had a warrant for $3600, upon which he collected $1800 at 2%, and the balance at 2½%; required the amount of the collector's fees.

ORIGINAL PROBLEMS.

1. What per cent. of the pupils in school are girls? What per cent. are boys?

2. Find the number of days you were present at school this month. What per cent. of the whole time were you present? What per cent. were you absent? Find your per cent. of attendance for the school-term.

3. Let the pupils ascertain the price of butter, eggs, etc., and then find the gain per cent. by selling these articles at 2 or 3 cents a pound more than market price.

4. Make original problems in interest.

5. Borrow money from a bank for 30 days, 60 days, etc., and calculate the discount.

6. Give the cost of an article and the rate of gain, to find the amount gained.

7. Give the cost of an article and the gain, to find the gain per cent.

8. Give the amount gained and the rate of gain, to find the cost of the article.

9. Give the amount of goods sold by an agent and his rate of commission, to find his commission.

10. Give the amount of goods sold and the commission, to find the rate of commission.

11. Give the commission and the rate of commission, to find the amount of goods sold.

ANSWERS TO WRITTEN EXERCISES.

Page 46.—*Ex. 2.* 9; *3.* 9; *4.* 8; *5.* 7; *6.* 7; *7.* 9; *8.* 9.

Page 47.—*Ex. 9.* 9; *10.* 9; *11.* 9; *12.* 8; *13.* 9; *14.* 8; *15.* 9; *16.* 8; *17.* 9; *18.* 9; *19.* 67; *20.* 88; *21.* 87; *22.* 95; *23.* 95; *24.* 89; *25.* 676; *26.* 996; *27.* 987; *28.* 979; *29.* 976; *30.* 889; *31.* 797; *32.* 999; *33.* 977; *34.* 787; *35.* $6987; *36.* $8769; *37.* $9886; *38.* $7879; *39.* $9989; *40.* $889.99; *41.* $979.78; *42.* $788.89; *43.* $899.67; *44.* 8937; *45.* 9767.

Page 48.—*Ex. 46.* 9948; *47.* 37698; *48.* 5688; *49.* 8988; *50.* 6679; *51.* 99988; *52.* 87979; *53.* 37486; *54.* 97 years; *55.* 879 acres; *56.* $475; *57.* 5625 bushels; *58.* 2766 pages; *59.* 4949 acres; *60.* $58.87; *61.* $1767.99; *62.* 677; *63.* 8899.

Page 49.—*Ex. 64.* 8779; *65.* $857.75.——*2.* 11; *3.* 12; *4.* 14; *5.* 19; *6.* 16; *7.* 18; *8.* 22; *9.* 18; *10.* 22; *11.* 30; *12.* 25; *13.* 24; *14.* 30; *15.* 25; *16.* 21; *17.* 35; *18.* 29; *19.* 19.

Page 50.—*Ex. 20.* 28; *21.* 34; *22.* 25; *23.* 21; *24.* 24; *25.* 27; *26.* 25; *27.* 39; *28.* 27; *29.* 21; *30.* 26; *31.* 37; *32.* 21; *33.* 27; *34.* 25; *35.* 24; *36.* 23; *37.* 31; *38.* 48; *39.* 54; *40.* 42; *41.* 51; *42.* 32; *43.* 41; *44.* 36; *45.* 34; *46.* 52.

Page 51.—*Ex. 3.* 121; *4.* 131; *5.* 131; *6.* 164; *7.* 151; *8.* 107; *9.* 185; *10.* 127; *11.* 208; *12.* 164; *13.* 192; *14.* 169; *15.* 1390; *16.* 1795; *17.* 1754; *18.* 1954; *19.* 1652; *20.* 1775; *21.* 2027; *22.* 2255; *23.* 2334; *24.* 1603; *25.* 2886; *26.* 2105; *27.* 2196; *28.* 2679; *29.* 2778; *30.* 2868; *31.* 2689; *32.* 2126; *33.* 1784; *34.* 2345; *35.* 2450; *36.* 2637; *37.* 2206; *38.* 2382.

Page 52.—*Ex. 39.* 22623; *40.* 22729; *41.* 29622; *42.* 22193; *43.* 25286; *44.* 20834; *45.* 24734; *46.* 37510; *47.* 31245; *48.* 20748; *49.* 267464; *50.* 280696; *51.* 212312; *52.* $280.55; *53.* $483.62; *54.* $329.15; *55.* $930.29; *56.* 19346; *57.* 187206; *58.* 31594; *59.* $304.10; *60.* $1572.46; *61.* $67.13.

Page 53.—*Ex. 1.* 3857 bu.; *2.* $16860; *3.* $30.50; *4.* $751; *5.* $11900; *6.* 30596 bricks; *7.* 11761 pounds; *8.* $22011; *9.* $21397.75; *10.* $151356; *11.* $109.32.

Page 54.—*Ex. 12.* 1439 miles; *13.* $2493.27; *14.* $24705; *15.* 4,920,228; *16.* 1806558; *17.* $4,153,000; *18.* 17,791,197.

Page 55.—*Ex. 19.* 5184; *20.* 8019; *21.* 8406; *22.* 4995; *23.* 5366; *24.* 639898; *25.* 451153; *26.* 504171; *27.* 511106; *28.* 498761; *29.* 531411; *30.* 5,323,882; *31.* 4,707,029; *32.* 236,482; *33.* 216,494.

Page 56.—*Ex. 34.* 86,179, total.

Page 59.—*Ex. 3.* 42; *4.* 24; *5.* 33; *6.* 45; *7.* 30; *8.* 24; *9.* 25; *10.* 33; *11.* 13; *12.* 32: *13.* 25; *14.* 223; *15.* 231; *16.* 621; *17.* 331; *18.* 201; *19.* 120; *20.* 47001; *21.* 46103; *22.* 11111; *23.* 26334; *24.* 24642; *25.* 1561420; *26.* 2611122; *27.* 2552223.

Page 60.—*Ex. 28.* 601; *29.* 413; *30.* 502; *31.* 8110; *32.* 100; *33.* 8213; *34.* 723; *35.* 210; *36.* 24; *37.* 3251; *38.* 2662; *39.* 9260; *40.* $112.27; *41.* $610.44; *42.* $5540.22; *43.* $822.02; *44.* $323.23; *45.* $353.22; *46.* $1113.25; *47.* $831.15; *48.* 42 cents; *49.* 530 sheep; *50.* $100; *51.* $114; *52.* $1130; *53.* 4364 men; *54.* $1233; *55.* 52 years; *56.* 10,701.

Page 61.—*Ex. 57.* 1520 bushels; *58.* $121,222.52; *59.* $10,054.20 lost.———*4.* 26; *5.* 25; *6.* 24; *7.* 43; *8.* 68; *9.* 425; *10.* 228; *11.* 216; *12.* 738; *13.* 532; *14.* 116.

Page 62.—*Ex. 15.* 308; *16.* 291; *17.* 158; *18.* 211; *19.* 81; *20.* 244; *21.* 187; *22.* 468; *23.* 178; *24.* 286; *25.* 265; *26.* 489; *27.* $106.08; *28.* $588.91; *29.* $360.16; *30.* $682.50; *31.* $23.58; *32.* 37139; *33.* 56288; *34.* 31346; *35.* 44328; *36.* $2999; *37.* $199.89; *38.* $8594; *39.* $9990; *40.* $13980; *41.* 49584; *42.* 19253; *43.* 10101; *44.* 50082; *45.* 527; *46.* 304; *47.* 198; *48.* 204; *49.* 256; *50.* 5980; *51.* 2174; *52.* 4621; *53.* 5337; *54.* 5914; *55.* 57149; *56.* 9211; *57.* 66772; *58.* 22415; *59.* 37810; *60.* 36611; *61.* 141106; *62.* 684494.

Page 63.—*Ex. 63.* 21542; *64.* 36898; *65.* 45401; *66.* 53702; *67.* 1787; *68.* 6,105,315; *69.* 213273; *70.* 99889.———*1.* 57 cents; *2.* 56 cents; *3.* 27 pins; *4.* 29 qts.; *5.* 88 words; *6.* 78 marbles; *7.* $47; *8.* 77 flowers; *9.* 1732; *10.* 70 yrs.; *11.* 75 yrs.; *12.* $550; *13.* 2837 men.

Page 64.—*Ex. 14.* $3888; *15.* 2004; *16.* 2333 ft.; *17.* $1782; *18.* 1797; *19.* 21636 votes; *20.* 7526 bu.; *21.* 3863 ft.; *23.* $3875; *24.* 2747 cattle.———*1.* 553; *2.* 597; *3.* 646; *4.* 174; *5.* 625; *6.* 2307; *7.* 10 cents.

Page 65.—*Ex. 8.* $1.10; *9.* $1.10; *10.* $300; *11.* $824; *12.* $339; *13.* $1873; *14.* $15; *15.* 15841.

Page 68.—*Ex. 9.* 268, 402, 536, 804; *10.* 502, 1004, 1506, 2008; *11.* $9.63, $16.05, $22.47, $28.89; *12.* 1824, 2280, 2736, 3192; *13.* 314, 628, 1099, 1256; *14.* 2892, 4338, 5061, 6507; *15.* 20105, 24126, 32168, 36189; *16.* 361224, 481632, 541836, 421428; *17.* 7494, 8743, 9992, 11241; *18.* 495663, 637281, 566472, 354045; *19.* 51840.

Page 69.—*Ex. 20.* 138936; *21.* 633255; *22.* 3105.———*1.* $2.15; *2.* $3.36; *3.* $2.45; *4.* $13.50; *5.* $1125; *6.* $42; *7.* 31680 feet; *8.* $292.25; *9.* $621.25; *10.* 1280 square rods; *11.* $93.75; *12.* $44.45; *13.* 477 miles; *14.* 2528 pages; *15.* $6.65; *16.* 51,840 grains; *17.* 1111111101; *18.* 8888888889.

Page 70.—*Ex. 5.* 1976; *6.* 4498; *7.* 10257; *8.* 3402; *9.* 7938; *10.* 5310; *11.* 14670; *12.* 8346; *13.* 12090; *14.* 18434; *15.* 24087; *16.* 36408; *17.* 31752; *18.* 113528; *19.* 165242; *20.* 244440.

Page 71.—*Ex. 21.* 431244; *22.* 799992; *23.* 578344; *24.* 1451026; *25.* 934848; *26.* 1998129; *27.* 277965; *28.* 1838274; *29.* 748660; *30.* 17146607; *31.* 7951044; *32.* 37395075; *33.* 16634061; *34.* 40689270; *35.* 47873384; *36.* 66139812; *37.* 13372205; *38.* 12173410; *39.* 9450617; *40.* 67781808.———*1.* $18139; *2.* $26076; *3.* $1228.50; *4.* $241.92; *5.* 5096 gal.; *6.* 85775 days; *7.* 2835 pounds; *8.* 99696 lbs., 1016256 lbs.; *9.* $1444; *10.* $1716.75; *11.* 109500 men; *12.* $163.84; *13.* 31488 cu. ft.

Page 72.—*Ex. 14.* 717120 cu. in.———*13.* 88200; *14.* 149500; *15.* 5841000; *16.* 77420000; *17.* 270900000; *18.* 32612000; *19.* 22400000; *20.*

304560000; *21.* 7614000000; *22.* 1281250000; *23.* 12220800000; *24.* 2852900000.

Page 73.—*Ex. 25.* $72; *26.* $300; *27.* 1728000 gr.; *28.* 15840000 ft.; *29.* 94000 pounds; *30.* $280000; *31.* $30000.———*1.* $362; *2.* $88.90; *3.* $18.30; *4.* $1946; *5.* $94.50; *6.* $1290; *7.* $4421.

Page 74.—*Ex. 8.* $1952; *9.* $1398; *10.* coal, $30.75; *11.* 4275 miles; *12.* 5040 miles; *13.* $2016; *14.* $940; *15.* $337.50; *16.* $21900; *17.* $2220000; *18.* 86400 sec.; *19.* $210; *20.* 1358024688; *21.* 75 cents.

Page 78.—*Ex. 2.* 123; *3.* 402; *4.* 210; *5.* 111; *6.* 111; *7.* 111; *8.* 323; *9.* 432; *10.* 101; *11.* 2002; *12.* 200; *13.* 2212.

Page 79.—*Ex. 16.* 108, 72, 54; *17.* 336, 224, 192; *18.* 385, 231, 165; *19.* 288, 252, 224, 504; *20.* 504, 432, 378, 336; *21.* 6245, 2 rem.; 4684, 1 rem.; 3747, 2 rem.; 3122, 5 rem.; *22.* 19619; 16349, 1 rem.; 14013, 4 rem.; 12261, 7 rem.; *23.* 8904, 4 rem.; 7915, 1 rem.; 11872, 4 rem.; 10176, 4 rem.; *24.* 28780, 17268, 12334, 2 rem.; 9593, 3 rem.; *25.* 40218, 20109, 13406, 10054, 4 rem.; *26.* 20614, 3 rem.; 17669, 4 rem.; 15460, 7 rem.; 13743; *27.* 129150, 6 rem.; 113007, 150676, 100450, 6 rem.; *28.* 70608, 52956, 60521, 1 rem.; 47072; *29.* $10.50, $6.30, $4.50, $3.50.———*1.* 14 pounds; *2.* 95 newspapers; *3.* 150 pounds; *4.* 122 hours; *5.* 1728 cans; *6.* 50 + hours.

Page 80.—*Ex. 7.* 996 rows; *8.* 256 weeks; *9.* 35 miles; *10.* $160; *11.* 176 bushels; *12.* $3201; *13.* 375 tons; *14.* 22 days; *15.* 519 sheep; *16.* 2181 books.

Page 81.—*Ex. 2.* 41; *3.* 31; *4.* 32; *5.* 21; *6.* 22; *7.* 23; *8.* 23; *9.* 25; *10.* 21; *11.* 45; *12.* 85; *13.* 82; *14.* 91; *15.* 111; *16.* 82; *17.* 71; *19.* 1230; *20.* 437; *21.* 1621; *22.* 1234; *23.* 1256; *24.* 526; *25.* 432; *26.* 418; *27.* $4.92; *28.* 758; *29.* 679; *30.* 586; *31.* 1234; *32.* 1456; *33.* 3082; *34.* 2573; *35.* 3456; *36.* $45.67.

Page 82.—*Ex. 38.* 102; *39.* 177; *40.* 256; *41.* 145; *42.* 147; *43.* 267; *44.* 576; *45.* $2.61; *46.* 378; *47.* 279; *48.* 481; *49.* 532; *50.* 191; *51.* 389; *52.* 467; *53.* $3.78.

Page 83.—*Ex. 64.* 23, rem. 5; *65.* 19, rem. 3; *66.* 12, rem. 9; *67.* 13, rem. 575; *68.* 109, rem. 454; *69.* 85, rem. 4; *70.* 39, rem. 747; *71.* 13, rem. 3014; *72.* 16, rem. 384; *73.* 14, rem. 432; *74.* 14, rem. 743; *75.* 9, rem. 6654; *76.* 4, rem. 9423; *77.* 2, rem. 2645; *78.* 5, rem. 321; *79.* 90, rem. 800; *80.* 41; *81.* 52, rem. 11000.———*1.* 144 doz.; *2.* 84 scores; *3.* 160 pounds; *4.* 1662 bu.; *5.* 103 bu.; *6.* $84; 7. 13 yr.; *8.* 104 barrels; *9.* $107.79 –; *10.* 1416 hhd.; *11.* 360 cows.

Page 84.—*Ex. 12.* $75; *13.* $45; *14.* 62 gal.; *15.* 378 sq. ft.; *16.* 48 barrels; *17.* 203 bu.; *18.* 131 boxes; *19.* 16 acres; *20.* 53 miles; *21.* 6 tons; *22.* 70 days; *23.* 207 hours; *24.* 306 yds.; *25.* 203 boxes; *26.* 112 companies; *27.* $12345; *28.* 28 bu.

Page 85.—*Ex. 1.* 6595; *2.* 7100; *3.* 3240; *4.* 42777; *5.* 49.

Page 86.—*Ex. 6.* 58; *7.* 2521; *8.* 61; *9.* 317646; *10.* 5462; *11.* 8654; *12.* $26240; *13.* 110 yards; *14.* $117; *15.* $43; *16.* $2072; *18.* $56.

Page 87.—*Ex. 19.* $770; *20.* 8232 pounds; *21.* $383.25; *22.* $187.50; *23.* 26796 cu. in.; *24.* $3150; *25.* $27144; *26.* $42.

Page 88.—*Ex. 2.* $492.30.

Page 89.—*Ex. 3.* $22.74; *4.* $237.90.

Page 90.—*Ex. 5.* $24.02; *6.* $77.24; *7.* $66.20; *8.* $207.94.

Page 92.—*Ex. 1.* $1222.22; *2.* $7640.87; *3.* $2727.04; *4.* $578.50; *5.* $101.17; *6.* $58.68; *7.* $695.30; *8.* $42.59; *9.* $389,018.25; *10.* $444445.05; *11.* $15256.04; *12.* $30597.33; *13.* $62.21.

Page 93.—*Ex. 1.* 171,026; *2.* 5121, 776334, 349565, 505145, 128465, 705521, 814211, 885852, 705121, 326753; *3.* 43371, 717411, 331673, 435412, 825391, 896102, 477503, 631586, 615395, 518523; *4.* 1111111101, 2222222202, 3333333303, 4444444404. 5555555505; *5.* 8888888889, 17777777778, 26666666667, 35555555556, 44444444445; *6.* 10738, 13442, 16146, 3432, 11310, 3224, 23452, 20956, 7852, 15912, 8346, 3692, 16432, 11856, 21684, 6084, 55770, 53196, 55900, 83616, 141232, 156234, 104832, 184080,——21476, 26884, 32292, 6864, 22620, 6448, 46904, 41912, 15704, 31824, 16692, 7384, 32864, 23712, 43368, 12168, 111540, 106392, 111800, 167232, 282464, 312468, 209664, 368160,——42952, 53768, 64584, 13728, 45240, 12896, 93808, 83824, 31408, 63648, 33384, 14768, 65728, 47424, 86736, 24336, 223080, 212784. 223600, 334464, 564928, 624936, 419328, 736320; *7.* 168, 216, 252, 276, 408, 504, 876, 1140, 1272, 1416, 1500, 2436, 3768, 6084, 9708, 11760, 312, 1212, 2772, 12600,——56, 72, 84, 92, 136, 168, 292, 380, 424, 472, 500, 812, 1256, 2028, 3236, 3920, 104, 404, 924, 4200,——28, 36, 42, 46, 68, 84, 146, 190, 212, 236, 250, 406, 628, 1014, 1618, 1960, 52, 202, 462, 2100.

Page 94.—*Ex. 1.* 3 days; *2.* 156, 1092, 4836; *3.* 4680, 112320, 3369600; *4.* $15775; *5.* $2214; *6.* 250 days; *7.* 1000 days; *8.* $1,839,005,677.09; *9.* 44000; *10.* $464; *11.* 8640 miles, 1440 miles.

Page 95.—*Ex. 12.* $9975; *13.* $19,340; *14.* $14,000; *15.* $91.80; *16.* 50715; *17.* $82; *18.* $220; *19.* $390; *20.* $2590; *21.* 124 acres; *22.* 1280; *23.* 200 yards.

Page 96.—*Ex. 24.* A $8, B $4; *25.* C $273, D $313; *26.* 5 mi. 2602 ft.; *27.* 1944 trees; *28.* 326 acres; *29.* $125; *30.* 17,952,000 ft.; *31.* Farmer owes mechanic $61.75; *32.* Merchant owes farmer $17.90.

Page 100.—*Ex. 14.* $26\frac{3}{8}$; *15.* $28\frac{4}{11}$; *16.* $25\frac{5}{12}$; *17.* $31\frac{7}{10}$; *18.* $22\frac{7}{15}$; *19.* $24\frac{5}{16}$; *20.* $20\frac{8}{17}$; *21.* $53\frac{12}{13}$; *22.* $22\frac{15}{23}$; *23.* $42\frac{5}{22}$; *24.* $56\frac{25}{33}$; *25.* $7\frac{3}{37}$; *26.* $25\frac{27}{39}$; *27.* $45\frac{7}{40}$; *28.* $36\frac{24}{41}$; *29.* $28\frac{25}{42}$.

Page 101.—*Ex. 18.* $\frac{43}{4}$; *19.* $\frac{103}{8}$; *20.* $\frac{104}{7}$; *21.* $\frac{142}{9}$; *22.* $\frac{62}{3}$; *23.* $\frac{245}{8}$; *24.* $\frac{268}{6}$; *25.* $\frac{271}{4}$; *26.* $\frac{575}{9}$; *27.* $\frac{757}{10}$; *28.* $\frac{682}{13}$; *29.* $\frac{928}{15}$; *30.* $\frac{1310}{21}$; *31.* $\frac{2132}{25}$; *32.* $\frac{1107}{11}$; *33.* $\frac{1531}{27}$; *34.* $\frac{1808}{17}$; *35.* $\frac{1437}{14}$; *36.* $\frac{2584}{5}$; *37.* $\frac{1600}{19}$; *38.* $\frac{678}{5}$; *39.* $\frac{377}{3}$; *40.* $\frac{1126}{7}$; *41.* $\frac{1685}{16}$; *42.* $\frac{1000}{9}$; *43.* $\frac{991}{8}$; *44.* $\frac{1174}{5}$.

Page 102.—*Ex. 16.* $\frac{2}{3}, \frac{2}{3}$; *17.* $\frac{5}{6}, \frac{5}{6}, \frac{5}{6}$; *18.* $\frac{1}{3}, \frac{1}{3}, \frac{1}{3}$; *19.* $\frac{2}{3}, \frac{2}{3}, \frac{2}{3}$; *20.* $\frac{3}{4}, \frac{3}{4}, \frac{3}{4}$; *21.* $\frac{5}{6}, \frac{5}{6}, \frac{7}{8}$; *22.* $\frac{7}{8}, \frac{11}{12}, \frac{9}{10}$; *23.* $\frac{5}{6}, \frac{2}{3}, \frac{11}{12}$; *24.* $\frac{12}{13}, \frac{12}{13}, \frac{2}{9}$; *25.* $\frac{3}{11}, \frac{3}{11}, \frac{3}{11}$.

Page 103.—*Ex. 27.* $\frac{24}{32}$; *28.* $\frac{50}{60}$; *29.* $\frac{35}{40}, \frac{49}{56}$; *30.* $\frac{45}{50}, \frac{72}{80}$; *31.* $\frac{24}{36}, \frac{32}{48}$; *32.* $\frac{12}{20}, \frac{27}{45}$; *33.* $\frac{9}{21}, \frac{27}{63}$; *34.* $\frac{30}{72}, \frac{40}{96}$; *35.* $\frac{35}{63}, \frac{60}{108}$; *36.* $\frac{39}{66}, \frac{52}{88}$; *37.* $\frac{44}{60}, \frac{66}{90}$; *38.* $\frac{20}{84}, \frac{25}{105}$; *39.* $\frac{80}{90}, \frac{168}{189}$; *40.* $\frac{96}{156}, \frac{104}{169}$; *41.* $\frac{56}{77}, \frac{88}{121}$; *42.* $\frac{35}{90}, \frac{30}{108}$; *43.* $\frac{400}{500}, \frac{480}{600}$; *44.* $\frac{84}{96}, \frac{105}{120}$; *45.* $\frac{8}{12}, \frac{9}{12}$; *46.* $\frac{6}{8}, \frac{7}{8}$; *47.* $\frac{20}{24}, \frac{18}{24}$; *48.* $\frac{12}{30}, \frac{25}{30}$; *49.* $\frac{12}{18}, \frac{15}{18}, \frac{10}{18}$; *50.* $\frac{18}{30}, \frac{21}{30}, \frac{16}{30}$; *51.* $\frac{6}{24}, \frac{21}{24}, \frac{10}{24}$; *52.* $\frac{16}{24}, \frac{18}{24}, \frac{21}{24}$. *53.* $\frac{42}{14}, \frac{8}{14}, \frac{9}{14}$; *54.* $\frac{18}{24}, \frac{20}{24}, \frac{21}{24}$; *55.* $\frac{30}{48}, \frac{9}{48}, \frac{30}{48}$; *56.* $\frac{20}{30}, \frac{18}{30}, \frac{13}{30}$; *57.* $\frac{16}{36}, \frac{15}{36}, \frac{14}{36}$; *58.* $\frac{15}{40}, \frac{16}{40}, \frac{22}{40}$; *59.* $\frac{20}{64}, \frac{32}{64}, \frac{3}{64}$; *60.* $\frac{21}{96}, \frac{6}{96}, \frac{11}{96}$; *61.* $\frac{39}{72}, \frac{64}{72}, \frac{45}{72}$; *62.* $\frac{12}{52}, \frac{24}{52}, \frac{17}{52}$.

Page 105.—*Ex. 26.* $1\frac{1}{2}$; *27.* $1\frac{1}{8}$; *28.* $1\frac{5}{24}$: *29.* $1\frac{41}{56}$; *30.* $\frac{13}{22}$; *31.* $\frac{9}{10}$; *32.* $\frac{37}{49}$; *33.* $\frac{57}{112}$; *34.* $\frac{29}{42}$; *35.* $\frac{41}{120}$; *36.* $2\frac{3}{8}$; *37.* $1\frac{23}{24}$; *38.* $2\frac{3}{28}$; *39.* $1\frac{29}{42}$;

40. $1\frac{71}{120}$; *41.* $\frac{5}{6}$; *42.* $2\frac{13}{40}$; *43.* $2\frac{13}{24}$; *44.* $1\frac{33}{56}$; *45.* $1\frac{1}{8}$; *47.* $34\frac{1}{12}$; *48.* $125\frac{1}{2}$; *49.* $398\frac{1}{8}$; *50.* $1045\frac{1}{8}$; *51.* $135\frac{17}{48}$; *52.* $28\frac{5}{8}$ yds.; *53.* \$$333\frac{3}{4}$; *54.* $79\frac{5}{8}$ miles; *55.* \$$137\frac{1}{2}$.

Page 106.—*Ex. 17.* $\frac{4}{63}$; *18.* $\frac{1}{12}$; *19.* $\frac{13}{36}$; *20.* $\frac{4}{15}$; *21.* $\frac{7}{30}$; *22.* $\frac{1}{42}$; *23.* $\frac{26}{105}$; *24.* $\frac{23}{72}$; *25.* $\frac{25}{156}$; $\frac{1}{132}$.

Page 107.—*Ex. 27.* $\frac{1}{42}$; *28.* $\frac{61}{105}$; *29.* $\frac{2}{19}$; *30.* $\frac{38}{75}$; *31.* $\frac{55}{126}$; *32.* $\frac{8}{208}$; *34.* $2\frac{1}{6}$; *35.* $5\frac{1}{6}$; *36.* $9\frac{1}{6}$; *37.* $8\frac{13}{24}$; *38.* $13\frac{7}{30}$; *39.* $18\frac{43}{60}$; *40.* $22\frac{2}{21}$; *41.* $34\frac{1}{2}$; *42.* $45\frac{2}{3}$; *43.* $59\frac{7}{8}$; *44.* $55\frac{19}{24}$; *45.* $64\frac{1}{7}$; *46.* $28\frac{2}{3}$; *47.* $33\frac{70}{143}$; *48.* $7\frac{7}{8}$; *49.* $11\frac{107}{112}$; *50.* \$$11\frac{3}{4}$; *51.* \$$83\frac{33}{40}$; *52.* \$$15\frac{1}{7}$; *53.* $1\frac{1}{72}$ cts.——*1.* $\frac{5}{12}$; *2.* $\frac{85}{168}$.

Page 108.—*Ex. 3.* $\frac{11}{18}$; *4.* $\frac{9}{20}$; *5.* $1\frac{73}{132}$; *6.* $\frac{149}{156}$; *7.* $\frac{7}{10}$; *8.* $1\frac{55}{84}$; *9.* $\frac{43}{60}$; *10.* $\frac{7}{8}$; *11.* $33\frac{53}{60}$; *12.* $3\frac{4}{7}$; *13.* $433\frac{3}{4}$ bu.; *14.* $140\frac{3}{4}$ bu.

Page 109.—*Ex. 2.* $321\frac{3}{7}$, $146\frac{2}{9}$; *3.* $264\frac{11}{16}$, $302\frac{7}{13}$; *4.* $104\frac{1}{6}$, $284\frac{2}{5}$; *5.* 190, $228\frac{8}{9}$; *6.* $298\frac{2}{3}$, $572\frac{1}{12}$; *7.* $436\frac{4}{11}$, $269\frac{3}{13}$; *8.* $1462\frac{8}{11}$, $783\frac{3}{23}$; *9.* 570, $753\frac{3}{5}$; *10.* \$90; *11.* \$6; *12.* \$$172\frac{4}{5}$; *13.* \$5420; *14.* \$$4\frac{2}{3}$; *15.* \$$358\frac{3}{4}$; *16.* \$134635; *17.* \$$133333\frac{1}{3}$; *18.* \$150.

Page 111.—*Ex. 14.* $\frac{1}{6}$; *15.* $\frac{4}{15}$; *16.* $\frac{8}{31}$; *17.* $\frac{4}{5}$; *18.* $\frac{1}{3}$; *19.* $\frac{85}{209}$; *20.* $\frac{2}{5}$; *21.* $\frac{8}{21}$; *22.* $\frac{189}{320}$; *23.* $\frac{27}{40}$; *24.* $\frac{4}{11}$; *25.* $\frac{1}{17}$; *26.* $\frac{392}{1485}$; *27.* $\frac{56}{135}$.

Page 112.—*Ex. 11.* $\frac{20}{29}$; *12.* $4\frac{3}{4}$; *13.* $\frac{3}{4}$; *14.* 30; *15.* $9\frac{1}{3}$; *16.* $8\frac{1}{3}$; *17.* $4\frac{3}{10}$; *18.* $24\frac{3}{4}$; *19.* $16\frac{7}{8}$; *20.* 5; *21.* $10\frac{8}{19}$; *22.* $16\frac{7}{8}$; *23.* 21; *24.* $17\frac{8}{11}$; *25.* $7\frac{2}{3}$; *26.* 40; *27.* $18\frac{2}{3}$; *28.* 144; *29.* $125\frac{10}{17}$; *30.* 156; *31.* $136\frac{7}{25}$; *32.* 105; *33.* $\frac{5}{6}$; *34.* $\frac{36}{37}$; *35.* $9\frac{9}{10}$; *36.* $\frac{32}{121}$; *37.* $\frac{7}{16}$; *38.* $\frac{3}{1760}$; *39.* $12\frac{14}{33}$; *40.* $1\frac{13}{21}$; *41.* 1; *42.* 3; *43.* 32.

Page 113.—*Ex. 45.* 400; *46.* 550; *47.* 1359; *48.* $416\frac{2}{3}$; *49.* $599\frac{1}{4}$; *50.* $383\frac{2}{5}$; *51.* $684\frac{8}{15}$; *52.* 1233; *53.* $223\frac{1}{2}$; *54.* $2530\frac{1}{2}$; *55.* $994\frac{2}{7}$; *56.* $2562\frac{18}{31}$; *57.* $819\frac{1}{7}$; *58.* 1072; *59.* $804\frac{4}{9}$; *60.* 1275; *61.* \$17; *62.* \$4.56; *63.* \$4.08; *64.* \$$173\frac{1}{3}$; *65.* \$4218; *66.* \$$346\frac{1}{2}$.

Page 114.—*Ex. 3.* $\frac{14}{27}$; *4.* $\frac{42}{125}$; *5.* $\frac{8}{15}$; *6.* $\frac{55}{153}$; *7.* $\frac{7}{9}$; *8.* $4\frac{3}{8}$; *9.* $\frac{5}{17}$; *10.* $\frac{7}{20}$; *11.* $\frac{3}{5}$; *12.* $\frac{825}{1792}$; *13.* $\frac{15}{28}$; *14.* $\frac{14}{45}$; *15.* $\frac{5}{27}$; *16.* $\frac{14}{33}$; *17.* $\frac{143}{210}$; *18.* $\frac{23}{63}$; *19.* $\frac{243}{256}$; *20.* $\frac{1}{6}$; *21.* $\frac{15}{28}$; *22.* $\frac{13}{44}$; *23.* $\frac{14}{65}$; *24.* $\frac{130}{783}$; *25.* $\frac{1}{12}$; *26.* $\frac{11}{16}$; *27.* $\frac{84}{125}$; *28.* $\frac{27}{1375}$; *30.* $95\frac{5}{6}$, $88\frac{2}{21}$; *31.* 117, 12; *32.* 260, 24; *33.* \$$30\frac{3}{16}$; *34.* \$$4\frac{1}{6}$; *35.* \$$8\frac{2}{5}$; *36.* $90\frac{3}{4}$ ft.; *37.* $130\frac{1}{2}$ cu. ft.; *38.* 374 sq. yd.

Page 116.—*Ex. 22.* $\frac{3}{5}$; *23.* $\frac{2}{25}$; *24.* $\frac{1}{7}$; *25.* $\frac{9}{16}$; *26.* $\frac{11}{135}$; *27.* $\frac{14}{201}$; *28.* $\frac{8}{45}$; *29.* $\frac{17}{209}$; *30.* $\frac{3}{50}$; *31.* $\frac{35}{481}$; *32.* $1\frac{4}{17}$; *33.* $\frac{27}{437}$; *34.* $\frac{8}{93}$; *35.* $\frac{1}{57}$; *36.* $\frac{25}{51}$; *38.* $4\frac{5}{18}$; *39.* $7\frac{7}{24}$; *40.* $2\frac{47}{126}$; *41.* $\frac{16}{51}$; *42.* $2\frac{1}{2}$; *43.* $2\frac{1}{2}$; *44.* $1\frac{1}{4}$; *45.* $1\frac{2}{5}$; *46.* $1\frac{1}{7}$; *47.* $\frac{23}{25}$; *48.* $133\frac{43}{56}$; *49.* $91\frac{5}{77}$; *50.* $486\frac{53}{72}$; *51.* $627\frac{3}{5}$; *52.* $321\frac{2}{9}$; *53.* $8\frac{8}{21}$.

Page 117.—*Ex. 2.* 12; *3.* 18; *4.* $57\frac{1}{2}$; *5.* 52; *6.* $20\frac{4}{7}$; *7.* $\frac{21}{50}$; *8.* $1\frac{17}{18}$; *9.* $\frac{28}{33}$; *10.* $2\frac{1}{10}$; *11.* $1\frac{1}{5}$; *12.* 80; *13.* $1\frac{1}{32}$; *14.* $93\frac{3}{14}$; *15.* 2; *16.* $106\frac{16}{17}$; *17.* $1\frac{23}{49}$; *18.* $\frac{72}{143}$; *19.* $\frac{7}{8}$; *20.* $2\frac{58}{99}$; *21.* 240; *22.* 462; *23.* $\frac{50}{77}$; *24.* $1\frac{4}{9}$; *25.* $928\frac{4}{5}$; *26.* $1\frac{203}{405}$; *27.* $\frac{50}{121}$; *28.* $681\frac{3}{4}$; *29.* $1\frac{2}{7}$; *30.* $1371\frac{1}{9}$; *31.* $1\frac{16}{49}$; *32.* $\frac{57}{64}$; *33.* $1619\frac{2}{3}$; *34.* $2\frac{2}{5}$; *36.* $1\frac{85}{112}$; *37.* $2\frac{7}{624}$; *38.* $\frac{1100}{8281}$; *39.* $5\frac{815}{4337}$; *40.* $2\frac{2}{3}$; *41.* 30 days; *42.* 40 sheep; *43.* 25 books; *44.* 36 hats; *45.* 35 quarts.

Page 118.—*Ex. 1.* $13\frac{1}{13}$; *2.* $15\frac{3}{14}$; *3.* $20\frac{7}{15}$; *4.* $23\frac{11}{16}$; *5.* $34\frac{5}{17}$; *6.* $42\frac{17}{18}$; *7.* $13\frac{7}{41}$; *8.* $51\frac{4}{91}$; *9.* $4\frac{68}{415}$; *10.* $7\frac{401}{402}$; *11.* $15\frac{5}{13}$; *12.* $28\frac{88}{97}$; *13.* $\frac{99}{10}$; *14.* $\frac{107}{12}$; *15.* $\frac{96}{7}$; *16.* $\frac{239}{15}$; *17.* $\frac{991}{31}$; *18.* $\frac{755}{12}$; *19.* $\frac{11332}{9}$; *20.* $\frac{13265}{161}$; *21.* $\frac{3194}{213}$; *22.* $\frac{8803}{12}$; *23.* $\frac{7486}{37}$; *24.* $\frac{160716}{401}$; *25.* $\frac{11}{12}$; *26.* $\frac{11}{13}$; *27.* $\frac{10}{13}$; *28.* $\frac{3}{5}$; *29.* $\frac{7}{9}$; *30.* $\frac{5}{7}$; *31.* $\frac{12}{13}$; *32.* $\frac{15}{16}$; *33.* $\frac{13}{15}$; *34.* $\frac{20}{21}$; *35.* $\frac{1}{3}$; *36.* $\frac{56}{57}$; *37.* $1\frac{19}{40}$; *38.* $\frac{1}{2}$; *39.* $1\frac{7}{40}$; *40.* $1\frac{17}{54}$; *41.* $1\frac{225}{616}$; *42.* $1\frac{52}{63}$; *43.* $39\frac{17}{24}$; *44.* $39\frac{31}{45}$; *45.*

$83\frac{19}{24}$; *46.* $105\frac{2}{3}$; *47.* $2\frac{13}{60}$; *48.* $2\frac{73}{120}$; *49.* $\frac{47}{60}$; *50.* $\frac{5}{6}$; *51.* $\frac{13}{42}$; *52.* $4\frac{1}{6}$; *53.* $5\frac{13}{24}$; *54.* $9\frac{11}{30}$; *55.* $3\frac{5}{6}$; *56.* $21\frac{4}{9}$; *57.* $20\frac{1}{2}$; *58.* $\frac{7}{12}$; *59.* $\frac{853}{504}$; *60.* $\frac{589}{660}$.

Page 119.—*Ex. 61.* 60; *62.* $105\frac{3}{5}$; *63.* $3\frac{9}{11}$; *64.* $12\frac{90}{103}$; *65.* $7\frac{8}{19}$; *66.* $68\frac{3}{4}$; *67.* $50\frac{1}{18}$; *68.* $1625\frac{5}{9}$; *69.* 384; *70.* $\frac{1}{2}$; *71.* $\frac{45}{64}$; *72.* $\frac{36}{125}$; *73.* $\frac{5}{37}$; *74.* $\frac{16}{85}$; *75.* $6\frac{1}{3}$; *76.* 27; *77.* $\frac{2}{3}$; *78.* $10\frac{7}{15}$; *79.* $7\frac{13}{21}$; *80.* $8\frac{1}{6}$; *81.* $\frac{9}{175}$; *82.* 14; *83.* $\frac{11}{12}$; *84.* $\frac{26}{125}$; *85.* 400; *86.* 110; *87.* $621\frac{3}{7}$; *88.* $338\frac{3}{4}$; *89.* $\frac{3}{5}$; *90.* $4\frac{4}{5}$; *91.* 5; *92.* $51\frac{1}{9}$; *93.* $\frac{9}{10}$; *94.* 1; *95.* $\frac{2}{3}$; *96.* $1\frac{7}{18}$; *97.* $\frac{5}{7}$; *98.* $2\frac{10}{11}$; *99.* $12\frac{36}{67}$; *100.* $7\frac{1}{2}$.———*1.* 30 cents; *2.* \$$3.67\frac{1}{2}$; *3.* $35\frac{15}{16}$ cents; *4.* \$162; *5.* \$966; *6.* \$$5\frac{3}{5}$; *7.* \$$4.67\frac{1}{2}$; *8.* 55 cents.

Page 120.—*Ex. 9.* \$$61\frac{5}{12}$; *10.* 2 cents; *11.* \$$37\frac{1}{12}$; *12.* $11\frac{1}{4}$ yds.; *13.* $14\frac{26}{309}$ acres; *14.* 300 sheep; *15.* 25 wks.; *16.* \$$43\frac{9}{25}$; *17.* 16; *18.* \$$183\frac{5}{8}$.———*2.* $84\frac{1}{2}$ cents.

Page 121.—*Ex. 3.* \$$272\frac{4}{5}$; *4.* \$12.30; *5.* \$$75\frac{3}{5}$; *6.* \$$56\frac{7}{10}$; *7.* \$103.70; *8.* \$$31\frac{7}{8}$; *9.* \$$1822\frac{1}{2}$.———*2.* \$4; *3.* $22\frac{1}{2}$ cts.; *4.* 90 cts.; *5.* 60 cts.; *6.* \$$1\frac{2}{7}$; *7.* $10\frac{5}{16}$ cents; *8.* $4\frac{1}{2}$ cents.

Page 122.—*Ex. 2.* \$20; *3.* \$4000; *4.* \$14400; *5.* \$33; *6.* \$120; *7.* 252 acres; *8.* \$69.60; *9.* 120 miles.

Page 123.—*Ex. 1.* $\frac{1}{15}$; *2.* $\frac{308}{22}$; *3.* $32\frac{5}{6}$; *4.* $\frac{146}{441}$; *5.* $3244\frac{8}{13}$; *6.* $3\frac{29}{36}$; *7.* 1503; *8.* $46\frac{2}{3}$; *9.* $\frac{1487}{1595}$; *10.* $53\frac{23}{40}$; *11.* $\frac{8966}{17}$; *12.* $\frac{25}{288}$; *13.* 96; *14.* $\frac{149}{259}$; *15.* 798; *16.* $\frac{348}{576}$, $\frac{171}{576}$; *17.* The 2d; *18.* $\frac{5}{6}$, $\frac{3}{4}$, $\frac{2}{3}$; *19.* $42\frac{7}{15}$; *20.* $\frac{5}{6}$; *21.* $\frac{1}{36}$; *22.* $\frac{1}{3}$; *23.* 1260; *24.* $\frac{175}{315}$, $\frac{168}{315}$; *25.* $41\frac{13}{24}$; *26.* $\frac{91884}{9}$; *27.* $\frac{21}{104}$; *28.* $\frac{16443}{81}$; *29.* 114; *30.* $1\frac{3}{5}$; *31.* $8\frac{1}{3}$; *32.* $72\frac{43}{50}$.

Page 124.—*Ex. 1.* $121\frac{1}{12}$ ft.; *2.* $198\frac{13}{24}$ acres; *3.* 80 cents; *4.* $2\frac{26}{27}$ days; *5.* $12\frac{5}{9}$ days; *6.* \$$74\frac{39}{40}$; *7.* $179\frac{41}{72}$ bu.; *8.* $148\frac{11}{84}$ rods; *9.* \$2.33; *10.* $\frac{57}{110}$; *11.* $1257\frac{1}{7}$ yd.; *12.* $16\frac{16}{99}$ perches; *13.* $7\frac{5}{6}$, $66\frac{7}{12}$ mi.

Page 125.—*Ex. 14.* $146\frac{17}{20}$ lb., \$$18.35\frac{5}{8}$; *15.* \$$11860\frac{4}{5}$; *16.* \$$4790\frac{1}{2}$; *17.* $57\frac{9}{13}$ lbs.; *18.* $44\frac{133}{144}$; *19.* \$$149\frac{1}{3}$; *20.* \$612; *21.* 720, 640; *22.* \$$86\frac{5}{8}$; *23.* \$$39\frac{9}{16}$; *24.* $81\frac{1}{9}$ rods; *25.* $294\frac{5}{12}$; *26.* $57\frac{7}{8}$; *27.* \$$8\frac{2}{5}$.

Page 126.—*Ex. 28.* 16 baskets; *29.* 6324; *30.* The first by 2; *31.* 39,962,298; *32.* \$$\frac{2}{5}$; *33.* \$685; *34.* \$765; *35.* $20\frac{4}{7}$ hours; *36.* \$$3.33\frac{1}{3}$; *37.* \$$1\frac{1}{4}$; *38.* $117\frac{1}{12}$ acres; *39.* \$70.06.

Page 130.—*Ex. 2.* $\frac{3}{5}$; *3.* $\frac{1}{4}$; *4.* $\frac{9}{20}$; *5.* $\frac{3}{4}$; *6.* $\frac{1}{8}$; *7.* $\frac{5}{8}$; *8.* $9\frac{1}{4}$; *9.* $10\frac{3}{4}$; *10.* $\frac{3}{40}$; *11.* $\frac{1}{16}$; *12.* $4\frac{1}{40}$; *13.* $28\frac{1}{4}$; *14.* $\frac{3}{16}$; *15.* $\frac{7}{80}$; *16.* $\frac{1}{800}$; *17.* $\frac{3}{400}$; *18.* $4\frac{1}{400}$; *19.* $\frac{7}{16}$.———*2.* .2; *3.* .5; *4.* .25; *5.* .125; *6.* .625; *7.* .875; *8.* .0625; *9.* .3125; *10.* .6; *11.* 2.6875; *12.* 6.25; *13.* 25.5; *14.* .4375; *15.* 8.375; *16.* 2.175; *17.* 9.48; *18.* 72.1625; *19.* 12.016.

Page 131.—*Ex. 2.* 143.91; *3.* 23.115; *4.* 15.328; *5.* 805.282; *6.* 200.8231; *7.* 847.1032; *8.* 71.6973; *9.* 15899.27981; *10.* 4637.33; *11.* 453.798; *12.* 620.448.———*2.* 76.67; *3.* 175.304; *4.* 38.0744; *5.* 391.4035; *6.* 268.6993; *7.* 8.24457; *8.* 11.91935; *9.* 21.51454; *10.* .99909; *11.* .000001.

Page 132.—*Ex. 2.* 2.436; *3.* .948; *4.* .16528; *5.* .2772; *6.* 2.0928; *7.* .26076; *8.* .141036; *9.* .008638; *10.* .00738; *11.* .09088; *12.* .000384; *13.* .24969; *14.* .188292; *15.* .015625; *17.* 67.854, 678.54, 6785.4, 67854; *18.* 3.141, 31.41, 314.1, 3141.

Page 133.—*Ex. 2.* .5; *3.* 1.25; *4.* 6.4; *5.* .7854; *6.* 1.5; *7.* 144; *8.* 42; *9.* 134; *10.* 620; *11.* 4320; *12.* 1600; *13.* 5000; *14.* 90000; *15.* .025; *16.* 10000; *17.* 10000; *18.* .0027; *19.* .0043; *20.* .035; *21.* 4230; *22.* 123.45; *23.* 4.1.

Page 134.—*Ex. 25.* 687.54, 68.754, 6.8754; *26.* .03, .003, .0003. ——— *1.* \$6.93875; *2.* \$239.6875; *3.* \$13755.9375; *4.* \$67.8125; *5.* \$31.7; *6.* $\$16.21\frac{1}{2}$; *7.* 47 barrels; *8.* \$266.94; *9.* 100; *10.* 12.3; *11.* 1015.875 gal.

Page 135.—*Ex. 12.* 532.125 cu. ft.; *13.* 12.5 bu.; *14.* \$102.1965; *15.* \$2385; *16.* 2000 marks; *17.* \$2316; *18.* 120 francs; *19.* 2.3; *20.* 21; *21.* 43.08; *22.* 2.5; *23.* .000002; *24.* 3,000,000; *25.* \$72.90; *26.* \$97.50; *27.* 415 acres; *28.* 21 horses; *29.* 10 hours.

Page 136.—*Ex. 2.* 42.5, .42, 14.87, 7.568, 148.32, .00001; *3.* $\frac{1}{4000}$; *4.* 2.8125; *5.* 1322.17931; *6.* 87431.9912568; *7.* .00209; *8.* 40000; *10.* $\frac{31}{32}$; *11.* .3875; *12.* .215; *13.* 522.195521; *14.* .00860925; *15.* 864132.5; *16.* 3,862,165,000; *17.* .0546875; *18.* \$180; *19.* 41600 cents; *20.* .0009; *21.* .00002; *22.* $57\frac{31}{40}$; *23.* 6286.8267; *24.* $\frac{1}{16}$; *25.* 539,784; *26.* $1\frac{3}{5}$.

Page 137.—*Ex. 27.* \$48.75; *28.* 12,225 tons; *29.* \$718.80; *30.* \$81.50; *31.* \$287.25; *32.* \$33513.97; *33.* \$6.255; *34.* 36 lb.; *35.* 290, .00072, 42.09918, .0000004; *37.* 579.644 tons; *38.* \$79.772; *39.* \$252.56.

Page 141.—*Ex. 11.* \$52.38; *12.* \$5.88; *13.* \$132; *14.* \$64.3125; *15.* 96 balls; *16.* $2\frac{1}{2}$ tons; *17.* \$63; *18.* \$220.32; *19.* 132072; *20.* 20 barrels.

Page 142.—*Ex. 21.* \$10.80; *22.* \$51.625; *23.* \$5.50.

Page 143.—*Ex. 10.* 4 gal.; *11.* 40 qt. 80 pt. 320 gi.; *12.* 24 qt.; *14.* 101 pt.; *15.* 121 pt.; *16.* 671 gi.

Page 144.—*Ex. 18.* 15 gal. 2 qt.; *19.* 15 gal. 2 qt. 1 pt. 2 gi.; *20.* \$1.65; *21.* 1848 cu. in., 2310 cu. in.; *22.* 13 gal.; *23.* \$5.07; *24.* \$13.72; *25.* 320 bottles.

Page 145.—*Ex. 10.* \$5.60; *11.* 4 bu.; *12.* 17 bu.; *13.* \$42; *14.* 4 bu. 3 pk. 5 qt.; *15.* 21504.2 cu. in.; *16.* \$6.54.

Page 147.—*Ex. 10.* 3360 min.; *11.* 31,536,000 sec.; *12.* 3,006,720; *13.* 174 days. ——— *9.* 259 sheets; *10.* $104\frac{1}{6}$ quires; *11.* \$43.20; *12.* \$86.40; *13.* \$110.

Page 149.—*Ex. 22.* 321 in.; *23.* 80 ft.; *24.* 18,819 ft.; *25.* 2 mi. 87 rd. 1 yd. 1 ft. 6 in.; *26.* 19800 ft.; *27.* 8 mi.; *28.* 660 ft., 40 rd., 7920 in.; *29.* \$396.

Page 150.—*Ex. 30.* \$34; *31.* 3200 mi.; *32.* \$1728; *33.* \$752.40.

Page 151.—*Ex. 6.* 1600 sq. rd.; *7.* 740 sq. rd.; *8.* 470,448 sq. in.; *9.* 33 A.; *10.* 9 sq. ft. 8 sq. in.; *11.* 16 A.; *12.* 12 sq. ft.

Page 152.—*Ex. 1.* 48 sq. ft.; *2.* 600 sq. ft.; *3.* 88 sq. yd.; *4.* 160 sq. rd.; *5.* 30 A.; *6.* 720 A.; *7.* 9 A.; *8.* 20 ft.; *9.* 64 rd.; *10.* 80 rd.; *11.* \$38.40; *12.* \$5.20; *13.* $\$11.13\frac{3}{4}$; *14.* \$9.28; *15.* \$41.58.

Page 153.—*Ex. 8.* 90 sq. in.; *9.* 15 A.

Page 154.—*Ex. 10.* 40 A.; *11.* 24 ft.; *12.* 160 rd.; *13.* $33\frac{1}{3}$ cts.

Page 155.—*Ex. 1.* 34560 cu. in.; *2.* 1536 cu. ft.; *3.* 396 cu. ft.; *4.* 20 cu. ft. ——— *1.* 1440 cu. ft.; *2.* 1080 cu. ft.; *3.* 9600 cu. ft.; *4.* $1436\frac{20}{77}$ gal.; *5.* $2356\frac{4}{11}$ gal.; *6.* 1687.47 + bu.

Page 156.—*Ex. 7.* 803.56 + bu.; *8.* $\$25.83\frac{1}{3}$; *9.* $58\frac{2}{11}$ perches; *10.* $387\frac{29}{33}$ perches; *11.* 150 cords; *12.* \$375; *13.* \$9.87 +; *14.* 6500 lbs.; *15.* $\$53.48\frac{4}{7}$; *16.* $2\frac{19}{40}$ ft.; *17.* 12 ft.; *18.* 20 ft.

Page 157.—*Ex. 19.* 9 ft.; *20.* $1066\frac{2}{3}$ ft.; *21.* \$9.75; *22.* \$15.84; *23.* \$48.60.

Page 158.—*Ex. 1.* 109,245″; *2.* 21600′; *3.* 1036°; *4.* 11° 45′ 45″. ——— *1.* 25.1328 in.; *2.* 37.6992 ft., 62.832 ft., 125.664 ft.; *3.* 251.328

yd.; *4.* 100 ft.; *5.* 381.97+ ft.——*2.* 201.0624 sq. ft., 314.16 sq. ft., 706.86 sq. ft.

Page 159.—*Ex. 3.* 113.0976 sq. ft.; *4.* 3216.9984 sq. ft.; *5.* 282.744 A.; *6.* 31.416 A.; *7.* 314.16 sq. ft.; *8.* 134.125 sq. ft.; *9.* 942.48 sq. ft.; *10.* 339.2928 sq. ft.

Page 160.—*Ex. 2.* 49 yr. 10 mo.; *3.* 63 yr. 2 mo. 26 da.; *4.* 56 yr. 1 mo. 13 da.; *5.* 55 yr. 6 mo. 14 da.; *6.* 47 yr. 11 mo. 16 da.; *7.* 67 yr. 9 mo. 22 da.; *8.* 57 yr. 2 mo. 8 da.; *9.* 16 yr. 2 mo. 18 da.; *10.* 7 yr. 9 mo. 1 da.; *12.* 84 yr. 3 mo. 11 da.

Page 161.—*Ex. 13.* 85 yr. 11 mo. 22 da.; *16.* 106 da.; *17.* 178 da.; *18.* 99 da.; *19.* 191 da.; *20.* Oct. 6th; *21.* June 3d; *22.* 227 da.; *23.* 487 da.; *24.* 153 da.

Page 162.—*Ex. 25.* 132 da.; *26.* 144 da.; *27.* 130 da.; *28.* 175 da.——*1.* 224½ lb.; *2.* 64 gal.; *3.* 11 bu.; *4.* 7 da.; *5.* 29040 ft.; *6.* 2640 ft.; *7.* 2240 sq. rd.; *8.* 10800 cu. ft.; *9.* 72000″; *10.* 6720 oz.; *11.* 504 pt.; *12.* 6784 qt.; *13.* 2592000 sec.; *14.* 11½ mi.; *15.* 123 ch.; *16.* 32 A.; *17.* 101 cu. ft.; *18.* 6°; *19.* 33212 oz.; *20.* 163 pt.; *21.* 351 qt.; *22.* 802 hr.; *23.* 12541 ft.; *24.* 460 sq. rd.; *25.* 53248 cu. ft.; *26.* 16 perches; *27.* 5775 cu. in.; *28.* 310 gal.

Page 163.—*Ex. 29.* 43008.4 cu. in.; *30.* 202 cd.; *31.* 421 A.; *32.* 528000 ft.; *33.* 353,927¼ da.; *34.* $3.84; *35.* 4320 pens; *36.* 96 cd.; *37.* $2.40; *38.* $43.80; *39.* $6.40; *40.* $4.20; *41.* 158400 steps; *42.* 192 inkwells; *43.* 184 baskets; *44.* 20 cts.; *45.* 25 cts.; *46.* 2268 sheets; *47.* $480.

Page 164.—*Ex. 48.* 4 bu.; *49.* $891; *50.* $2475; *51.* $105; *52.* $1125; *53. 53.* 600 sq. ft.; *54.* $38\frac{26}{33}$ perches; *55.* 20 ft.; *56.* 6 ft.; *57.* 48 ft.; *58.* 20 in.; *59.* 12 in.; *60.* $45; *61.* $80; *62.* 5760 perches; *63.* $13⅓.

Page 165.—*Ex. 64.* $115.06¼; *65.* $49.86; *66.* $213\frac{393}{539}$ bbl.; *67.* $295.31¼; *68.* 54.9376 sq. rd.; *69.* $132.30; *70.* $20; *71.* $74.25; *72.* $907.20; *73.* 17820 cu. ft.; *74.* $173.57+.

Page 168.—*Ex. 14.* 1.32; *15.* 8.61; *16.* 42.8 A.; *17.* 85 mi.; *18.* 36 T.; *19.* $43.75; *20.* 450 horses; *21.* 13.02 lbs.; *22.* $45.40; *23.* $900; *24.* $6048; *25.* $1230; *26.* 2036.1 lbs.; *27.* 676 girls; *28.* $1701.

Page 169.—*Ex. 12.* 6%; *13.* 5%; *14.* 10%; *15.* 50%; *16.* 75%; *17.* 33⅓%; *18.* 16⅔%; *19.* 25%; *20.* 10%; *21.* 50%; *22.* 40%; *23.* 8%; *24.* 16⅔%; *25.* 24%; *26.* 25%.

Page 170.—*Ex. 27.* 20%; *28.* 66⅔%; *29.* 20%; *30.* 16⅔%.——*10.* 500; *11.* 310; *12.* 1500.

Page 171.—*Ex. 13.* 200; *14.* 300; *15.* 3200; *16.* 1900; *17.* 2200; *18.* 1300; *19.* 830 A.; *20.* $3520; *21.* $4820; *22.* $250; *23.* $400; *24.* $5625.——*1.* $332.97½; *2.* 25%; *3.* 400 bbl.; *4.* $2000; *5.* $100; *6.* 400 sheep; *7.* 100.

Page 172.—*Ex. 8.* 50%; *9.* $8000; *10.* 20%; *11.* 80%; *12.* 550; *13.* 45; *14.* 630 corn, 420 wheat, 210 oats; *15.* $464; *16.* $200; *17.* $280; *18.* 25%; *19.* 25%; *20.* $608; *21.* 40%; *22.* $9200; *23.* 25%; *24.* $810; *25.* $1280.

Page 173.—*Ex. 26.* $8500; *27.* 25%; *28.* $1600; *29.* $235; *30.* 100%.

Page 174.—*Ex. 13.* $48; *14.* $122.50; *15.* $57.60; *16.* $150; *17.*

$324; *18.* $576; *19.* $90; *20.* $276; *21.* $832; *22.* $82; *24.* $235; *25.* 463\frac{1}{3}$; *26.* $655; *27.* $424.32.

Page 175.—*Ex.* *28.* $740; *29.* $1802; *30.* $388.79 –; *31.* $97.57 –; *32.* $201.77 –.———*6.* $2.52; *7.* $12.48; *8.* $36.675; *9.* $214; *10.* $423.

Page 176.—*Ex.* *11.* $45; *12.* $8; *13.* $3.75; *14.* $1.9375; *15.* 13\frac{1}{3}$; *16.* 19.83\frac{1}{3}$; *17.* $55; *18.* $143.50; *19.* $122.50; *20.* 93.33\frac{1}{3}$; *21.* $402; *22.* $3628.80; *23.* $626.40; *24.* $1163.82; *25.* 16.83\frac{3}{4}$; *26.* $5591.82; *27.* $600.90; *28.* 2176.58\frac{1}{3}$; *29.* $550.25+; *30.* $145.60; *31.* $956.34; *32.* $1215.93+; *33.* $460.56; *34.* $435.51; *35.* $6295.03; *36.* $418.80.

Page 177.—*Ex.* *1.* $2.10; *2.* $1.86; *3.* 1.93\frac{1}{3}$; *4.* $1.85; *5.* $590.70; *6.* $829.71; *7.* $1191.20; *8.* $246.125; *9.* $1244.565; *10.* $2978; *11.* $123.55 –.———*1.* $60960; *2.* 883 bu.; *3.* $69725.

Page 178.—*Ex.* *4.* 15264 mi.; *5.* 3249 mi.; *6.* $39; *7.* $3890; *8.* 1170 mi.; *9.* $1650; *10.* $162; *11.* 102 days; *12.* 26400 rev.; *13.* $3000; *14.* 5 cts.

Page 179.—*Ex.* *15.* $10; *16.* 50688; *17.* 40; *18.* 136\frac{71}{78}$; *19.* $4439.40; *20.* 1,589,041$\frac{7}{73}$ mi.; *21.* 500 mi.; *22.* $68.40; *23.* $61.20; *24.* 1350, 1400; *25.* $25; *26.* Lost $6; *27.* 2$\frac{238}{315}$; *28.* $\frac{11667}{87}$; *29.* 276$\frac{12}{29}$; *30.* $\frac{15}{16}$.

Page 180.—*Ex.* *31.* 6$\frac{10}{21}$; *32.* $\frac{2}{11}$; *33.* $\frac{608}{1155}$; *34.* $126; *35.* 16$\frac{94}{105}$; *36.* 145$\frac{7}{25}$ lb.; *37.* 167\frac{7}{8}$; *38.* 1534\frac{2}{5}$; *39.* 5$\frac{1}{2}$ cts.; *40.* 12\frac{1}{2}$; *41.* 2310 ft.; *42.* 36 mi.; *43.* 18 yr.

Page 181.—*Ex.* *45.* 4 A.; *46.* 66.66\frac{2}{3}$; *47.* 46.66\frac{2}{3}$; *48.* 78 yr. 2 mo. 23 da.; *49.* $2000; *50.* $596; *51.* $150; *52.* 25%; *53.* 700; *54.* 150%; *55.* $583.24; *56.* $5836.50; *57.* $200; *58.* 11$\frac{1}{9}$%; *59.* .0025; *60.* $\frac{1}{2}$%; *61.* $487.20; *62.* $739.48.

Page 182.—*Ex.* *63.* $1181.40; *64.* $81.

MULTIPLICATION TABLES.

1 × 1 = 1	2 × 1 = 2	3 × 1 = 3	4 × 1 = 4
1 × 2 = 2	2 × 2 = 4	3 × 2 = 6	4 × 2 = 8
1 × 3 = 3	2 × 3 = 6	3 × 3 = 9	4 × 3 = 12
1 × 4 = 4	2 × 4 = 8	3 × 4 = 12	4 × 4 = 16
1 × 5 = 5	2 × 5 = 10	3 × 5 = 15	4 × 5 = 20
1 × 6 = 6	2 × 6 = 12	3 × 6 = 18	4 × 6 = 24
1 × 7 = 7	2 × 7 = 14	3 × 7 = 21	4 × 7 = 28
1 × 8 = 8	2 × 8 = 16	3 × 8 = 24	4 × 8 = 32
1 × 9 = 9	2 × 9 = 18	3 × 9 = 27	4 × 9 = 36
1 × 10 = 10	2 × 10 = 20	3 × 10 = 30	4 × 10 = 40
1 × 11 = 11	2 × 11 = 22	3 × 11 = 33	4 × 11 = 44
1 × 12 = 12	2 × 12 = 24	3 × 12 = 36	4 × 12 = 48
5 × 1 = 5	6 × 1 = 6	7 × 1 = 7	8 × 1 = 8
5 × 2 = 10	6 × 2 = 12	7 × 2 = 14	8 × 2 = 16
5 × 3 = 15	6 × 3 = 18	7 × 3 = 21	8 × 3 = 24
5 × 4 = 20	6 × 4 = 24	7 × 4 = 28	8 × 4 = 32
5 × 5 = 25	6 × 5 = 30	7 × 5 = 35	8 × 5 = 40
5 × 6 = 30	6 × 6 = 36	7 × 6 = 42	8 × 6 = 48
5 × 7 = 35	6 × 7 = 42	7 × 7 = 49	8 × 7 = 56
5 × 8 = 40	6 × 8 = 48	7 × 8 = 56	8 × 8 = 64
5 × 9 = 45	6 × 9 = 54	7 × 9 = 63	8 × 9 = 72
5 × 10 = 50	6 × 10 = 60	7 × 10 = 70	8 × 10 = 80
5 × 11 = 55	6 × 11 = 66	7 × 11 = 77	8 × 11 = 88
5 × 12 = 60	6 × 12 = 72	7 × 12 = 84	8 × 12 = 96
9 × 1 = 9	10 × 1 = 10	11 × 1 = 11	12 × 1 = 12
9 × 2 = 18	10 × 2 = 20	11 × 2 = 22	12 × 2 = 24
9 × 3 = 27	10 × 3 = 30	11 × 3 = 33	12 × 3 = 36
9 × 4 = 36	10 × 4 = 40	11 × 4 = 44	12 × 4 = 48
9 × 5 = 45	10 × 5 = 50	11 × 5 = 55	12 × 5 = 60
9 × 6 = 54	10 × 6 = 60	11 × 6 = 66	12 × 6 = 72
9 × 7 = 63	10 × 7 = 70	11 × 7 = 77	12 × 7 = 84
9 × 8 = 72	10 × 8 = 80	11 × 8 = 88	12 × 8 = 96
9 × 9 = 81	10 × 9 = 90	11 × 9 = 99	12 × 9 = 108
9 × 10 = 90	10 × 10 = 100	11 × 10 = 110	12 × 10 = 120
9 × 11 = 99	10 × 11 = 110	11 × 11 = 121	12 × 11 = 132
9 × 12 = 108	10 × 12 = 120	11 × 12 = 132	12 × 12 = 144